EXHIBIT 4

UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF MICHIGAN

SOUTHERN DIVISION

LEAGUE OF WOMEN VOTERS OF MICHIGAN, ROGER J. BRDAK, FREDERICK C. DURHAL, JR., JACK E. ELLIS, DONNA E. FARRIS, WILLIAM "BILL" J. GRASHA, ROSA L. HOLLIDAY, DIANA L. KETOLA, JON "JACK" G. LASALLE, RICHARD "DICK" W. LONG, LORENZO RIVERA, and RASHIDA H. TLAIB,

Plaintiffs,

vs

RUTH JOHNSON, in her official capacity as Michigan Secretary Of State,

Defendant.

Case No. 2:17-cv-14148-DPH-SDD

DEPOSITION OF JOWEI CHEN,

Taken by the Defendants on Friday, September 7, 2018, at the offices of Dickinson Wright, PLLC, 350 South Main Street, Suite 300, Ann Arbor, Michigan, at 9:34 a.m.

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REPORTED BY: Ms. Marjorie Covey, CSR-2616

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(EXHIBITS WERE RETAINED BY THE COURT REPORTER FOR INCLUSION IN THE TRANSCRIPT.)

Ann Arbor, Michigan
September 7, 2018 - 9:34 a.m.

THE REPORTER: Do you solemnly swear the testimony you are about to give will be the truth, the whole truth and nothing but the truth?

MR. JOWIE CHEN: Yes.

JOWIE CHEN,

HAVING BEEN CALLED BY THE DEFENDANT AND SWORN:

EXAMINATION

BY MR. YEAGER:

Q. Good morning, Professor Chen. How are you?

A. Good morning, sir, I'm doing well.

Q. I know you had your deposition taken before, I just want to make two points at the beginning. The court reporter will need a verbal response, not a nod or something like that to make the record clear. And if there is any questions that I'm asking that you are confused about, please ask me to clarify.

Will you swear on that?

A. Yes, sir.

Q. Okay. Is there any reason, medications or otherwise that you can't testify fully or truthfully today?

A. No, sir.

(At 9:35 a.m. Exhibit 1 marked.)

Q. Okay. If you could look at what's been marked as Chen

Exhibit 1, please.

Is that the report you entered in this case?

A. It appears to be so, sir.

Q. Okay. And on the first page you list the cases that you've previously been involved with, is that right, down at the bottom?

A. Yes, sir.

Q. Okay. Let's start with the cases that you provided trial testimony on.

MR. YEAGER: Mike, if I could just interrupt. On the document there was an errata submitted after the report. I don't know if you have that.

MR. CARVIN: I don't have it, but if it comes up in any way, that stipulation is on the record, and if there is typos or things like that, we'll -- please point it out.

BY MR. CARVIN:

Q. So let's start with this, if we could, City of Greensboro versus Guilford County Board of Elections.

Was that a situation where they banned Greensboro from participating in referendum?

A. I just want to see where you're starting -- you're going to the middle of the paragraph.

Q. I'm going to the ones where I think you said you offered the trial testimony.

A. I see. Let me get to where that starts.

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Q. Sure.
A. Okay. The first one listed was Raleigh Wake, but you want to ask about the City of Greensboro.
Q. Yes, please.
A. And if I could just ask you to repeat the question.
Q. What did the case involve?
A. I believe -- I recall that it was a challenge to a newly redrawn Greensboro City Council districting plan for the City of Greensboro.
I think you had mentioned a referendum. I don't recall -- I don't recall or don't know about that. But I recall that the case, to my recollection the case involved the Greensboro City Council districting plan and that was redrawn.
Q. And what was the alleged flaw in the city council redistricting plan?
A. My recollection, to the best of my knowledge, is that plaintiffs were arguing a violation of one-person one-vote of some sort. And plaintiffs were alleging that it had been done -- the violation of one-person one-vote had been done in a partisan and racial manner. That's my recollection.
Q. Now maybe to refresh your recollection, that was the issue in the Wake County case, the Raleigh Wake Citizens v Wake County, right? They argued they were underpopulated on a racial and political basis?

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A. That is my recollection. I believe that plaintiffs were making a similar argument regarding one-person one-vote done in a partisan racial manner.
Q. Okay. And what was your testimony in that case?
A. I -- you're asking now about Raleigh Wake County?
Q. No. No. I'm sorry. I'm trying to keep this clear.
No. I've been asking about City of Greensboro.
A. The Greensboro case, okay, I'll go back to the Greensboro case.
Let me try and remember as best as I can. I just want to qualify it was sometime ago, but I'll do my best here.
I ran an expert report in that case where I analyzed the, number one, the population disparities; number two, the partisanship; and then number three, the racial composition of the districts in the enacted plan.
I compared those various numbers in various ways to a few hundred computer simulations that I did of Greensboro City Council districting plans. The computer produced districting plans for Greensboro.
And I reported on the differences that I saw between the computer-simulated plans and the enacted city council plans on those various measures.
Q. With respect to its partisan outcome, did you analyze, compare the enacted plan to the simulations in terms of the

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efficiency gap or the mean-median difference -- median-mean difference?
A. Let me try and remember. And again, I'm just going to qualify, I'm going to do the best I can to remember, but it's been awhile.
MR. YEAGER: Objection.
Don't guess. You can testify.
THE WITNESS: My recollection is that I analyzed the districts, both the enacted districts and the computer simulated districts in terms of partisanship just by counting up the number of districts and identifying districts as either Republican leaning or Democratic leaning.
My recollection is I did not attempt to calculate an efficiency gap for any of those plans.
I think you asked me about something other than efficiency gap. Did I miss something else?
BY MR. CARVIN:
Q. Median-mean --
A. Median-mean, thank you.
I'm not going to guess, I'm just going to admit that I can't remember precisely.
Q. Okay.
A. I just can't remember everything that I did.
I recall that I definitely calculated the number of Republican districts; and I might have, and I might not have

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reported on, say, the median district partisanship. So I just can't recall specifically doing that.
Q. All right. Well let's switch to Wake County, the Raleigh Wake Citizens case.
As I understand what you told me a moment ago you did the same kind of analysis of the population differences and whether that reflected partisan differences?
A. Yes, sir. I did the same fundamental sort of analysis as I just described a moment ago.
Q. Including comparing it to simulated plans?
A. Yes, sir.
Q. Okay. And in that case, do you recall whether or not one of your measures of the partisan outcome was either the efficiency gap or the mean -- median-mean difference?
A. Okay. Again, I'm going to qualify that I'll do the best I can to remember. This was, I think it was a case in 2015 so it's been awhile.
My recollection is that I did not calculate the efficiency gap. It's possible that I calculated the median district in some way using partisanship numbers. I don't specifically recall doing that, so I'm not going to say for sure that I did or did not. I don't specifically recall doing so with respect to the mean-median.
But I definitely recall that I did not calculate the efficiency gap of either the enacted plan -- let me go

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back and qualify.

When I say enacted plan, we're actually talking about two different enacted plans in that case that I analyzed. So what I'm saying applies to both of them. I don't recall analyzing or calculating an efficiency gap for either of those enacted plans.

And I can't recall specifically calculating a mean-median. I'm not going to say for sure that I didn't calculate something like the median.

Q. Okay. And then let's switch to League of Women Voters versus the Commonwealth of Pennsylvania, that's more recent.

Did you do an analysis essentially similar to what you did in this case?

A. I wouldn't call it essentially similar. I mean obviously there were differences. But I'll characterize it kind of briefly, and hopefully that will answer your question.

In this -- in the Pennsylvania case, I analyzed the enacted Congressional map in Pennsylvania. I analyzed it on partisan -- on various partisan measures. And then I performed some number of, I think several hundred computer-simulated plans. And I compared the partisan numbers, the partisan calculations of the simulated plans to the enacted plan.

Q. In Pennsylvania did you run a second set of simulated plans that were designed to protect incumbents?

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A. My recollection is that, yes, I did a second set. I can't remember if it was labeled as the first or the second. But I recall doing a set of simulations that did protect incumbents in the following sense, and I'm just going to explain what I meant when I said protect incumbents.

In that particular case, I was given, I believe, the residential addresses of incumbents, of incumbent politicians at some point in time. And I determined what sort of plans would minimize the number of incumbents that were double paired into a single district.

So that is the sense in which I mean protecting incumbents.

Q. Just so I'm clear, you used the phrase double paired; if two incumbents are placed in one district, would that be what you would characterize as doubled paired?

A. That is what I -- that is how I operationalized it. I understand that that's not necessarily the only way that that term is used. But I'm just talking about how I operationalized the term in my report in that case.

So I think you characterized it correctly there. I sought to analyze what sort of districting algorithm -- or what sort of districting plans would emerge from an algorithm that made a conscious effort that intentionally tried to minimize putting two or more incumbent addresses, residential addresses, into the geographic -- within the geographic

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boundaries of a single district.

So if there were two incumbents within a district, that would be double pairing. I guess if there were three, maybe we would call that triple pairing. But the point is that the algorithm was trying to intentionally avoid or minimize that from happening.

Q. You have not run any such analysis here in this case, correct?

A. In the Michigan -- in my analysis of the Michigan plans? And that is correct. I have not done a comparable analysis on Michigan plans.

Q. Why not?

A. You're asking me about my expert report now?

Q. Right.

A. You're asking me why I didn't do an analysis of that sort of double pairing, double bunking, double pairing avoidance.

And the answer is that, number one, Plaintiffs' counsel did not ask me to do such an analysis; and number two, I read the statutory criteria, and I reference those in my report, MCL 4.261 and 3.63, and they do not reference that as a redistricting goal.

Q. And it's your understanding of the statutory criteria that they're exhaustive?

A. That is my understanding.

Q. So if they don't reference avoiding pairing of incumbents,

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then it would be inconsistent or violative of those statutory criteria for a redistricting plan to avoid pairing incumbents?

A. That is a legal judgement that I'm not qualified to opine on.

All I was saying a moment ago is that my understanding is that the statutory criteria do not call for explicitly attempting to protect incumbents.

Q. We'll get into this in more detail, but as I understand your report, your understanding is that the listed criteria are the exhaustive criteria, the only ones that can be considered by those drawing plans in Michigan, is that correct?

A. Okay. I'm just going to clarify that I understand that to be two possibly different questions so I'm going to take them one at a time.

So I'm just going to tell you what I understand to mean by the question first. And then I'll answer the questions so that there is no ambiguity about what I'm trying to answer here.

When I understood the term exhaustive, all I meant for that -- all I meant is that I understood that I was going to operationalize and conduct analysis using only an exhaustive list of criteria.

I don't understand -- now the second part of your question contained the word can, and that possibly -- I'm not sure what you mean by that question. It might mean in a

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legal sense whether it's legally permissible. And of course on that I'm not at all qualified to opine as to what the legal meaning might be in this case.

I am just telling you that I read the criteria, the statutory criteria, I had conversations with Plaintiffs' counsel, and I understood by the question put forth to me to be to analyze the sort of plans that would emerge if I had -- if I analyzed an exhaustive list of criteria.

So that's all I meant when I answered your earlier question.

Q. And to be clear the exhausted list of criteria are those referenced in the two statutes that you referred to earlier?

A. Yeah. That's correct. I'm following the criteria that I read, that I saw listed in the -- in those two statutes.

Q. Do you have any understanding as to whether or not it would be permissible under those statutes to consider nonpartisan criteria other than those explicitly listed in the statutes?

A. If you mean admissible in any legal sense, again I'm going to give the same answer which is that I'm not qualified to tell you whether it's legally permissible.

Q. Okay.

A. I can tell you how I took those criteria and I built them into my own computer simulation, so I can tell you whether they were permissible in a computer simulation in that sort of technical sense.

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And as you know, I did not explicitly consider, I didn't build in any partisan considerations. I instructed the computer to ignore partisan considerations.

Q. I'm talking about nonpartisan considerations.

A. I'm sorry, I misheard you. I apologize.

Q. For example, avoiding pairing of incumbents, is it your understanding that under the statutory criteria that would be a permissible, traditional districting principle that would be acceptable under the criteria as enumerated in the statute?

A. Okay, I got you, I heard your question this time. I apologize for that.

So I'm going to give the same answer as before which is that if you're asking permissible in any legal sense, I obviously can't tell you whether or not the statute is to be interpreted as making something legally or not legally permissible. So I can't give you an opinion with respect to the legality, the legal permissibility of a nonpartisan criteria.

I can tell you only about the analysis that I did, which is that I obviously did not make it permissible for my computer, for my simulation plans to be drawn with respect to a nonpartisan criterion like avoiding the pairing of incumbents.

So I just want to make that distinction.

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Q. That's fine. And in Pennsylvania did you use a compactness measure known as Polsby-Popper?

A. My recollection -- I don't have the report in front of me so I'm going to do my best to remember.

My recollection is that I did. That's my best recollection.

Q. Did you use Polsby-Popper as a measure of compactness in this case?

A. My recollection is that I did not analyze Polsby-Popper measures in my report.

Q. Why not?

A. Well, I analyzed two different measures in my report here.

I calculated the Reock score, which is probably a very common, perhaps the most common -- I'm not really saying it's definitely the most common, but it's certainly a very common measure of compactness.

And on top of that, I found in reading the statute, that the statutes give what seems to be a precise definition, Michigan specific definition, or a method of calculating the compactness of quantifying the compactness of districts.

And so I placed -- because I saw that in the statute, I placed some greater importance on trying to, at least try to follow that calculation or that method of quantifying compactness that I read in the statute.

So if you're asking -- I think you're asking about

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why didn't I do it in Michigan whereas I did in Pennsylvania.

And the answer is I had, in Michigan, I had in front of me a statute that laid out a, what to me was a pretty specific quantifiable definition of compactness; whereas in Pennsylvania, I didn't have such a specific -- such a specific definition put forth to me.

Q. In addition to the statutory specific definition of compactness, which I'll call the circumscribed circle test, in Michigan you also analyzed compactness under the Reock test, correct?

A. Yes, sir.

Q. Why did you use a measure of compactness in addition to the ones specified in the statute?

A. It's just something that I commonly do. It's not necessarily something that I thought was based on the statute specifically, but certainly it's been my experience that, number one, compactness is a traditional districting criterion, and so very commonly I'll use Reock as a measure.

So it's just because I've done it by practice.

Q. But you've also used Polsby-Popper, and why did you Reock and not do Polsby-Popper in this case?

A. I could well have, but I think that in general I use Polsby-Popper a bit less commonly. So it's by practice that I included the Reock measure.

Q. Do you recall that you used the median-mean measure of

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partisan bias in Pennsylvania?
A. It's my recollection that I did include some calculations of mean-median gap -- or I think I called it mean-median difference --
Q. Okay.
A. -- in my Pennsylvania report.
Q. All right. And did you use any efficiency gap measures of partisan bias in Pennsylvania?
A. Efficiency gap measures of partisan bias is what you asked about?
Q. Yes.
A. I'm going to do my best to try to remember. I'll qualify by saying it's been awhile since I have looked at that report.
My best recollection right now is that I did, but I'm just trying to do my best to remember.
Q. So your best recollection is that you did do an efficiency gap analysis in the Pennsylvania case?
A. That's my best recollection right now.
Q. Okay. And in --
A. And again I'm just qualifying that it's been awhile since I looked at that report.
Q. Okay. And North Carolina Rucho?
A. The Rucho case?
Q. Yes.
A. Yes, sir.

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Q. In that case, did you run simulations that factored in incumbency protection?
A. Let me try to remember.
My recollection is that in my report in the Rucho case, I conducted several different sets of simulations. I recall I conducted a first set of simulations that, in addition to following traditional redistricting criteria that were set forth in the adopted criteria that the legislature had, I did not program the simulation algorithm in that first set to take into consideration the location of incumbents or any sort of incumbent protection.
So that was one set of simulations that I analyzed in the report.
I recall that there was another set of simulations that, in addition to the nonpartisan traditional districting criteria, did in fact explicitly attempt to maximize the number of single -- or isolated incumbents. In other words it tried to minimize double or triple pairing of incumbents, tried to separate out incumbents into separate -- into separates districts without pairing or triple pairing -- or tripling any incumbents into a single district.
So I took two different approaches there. And that's my best recollection.
So again I just want to qualify that when I say protecting incumbents, what I actually did was to avoid double pairing.

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Q. And did you do a mean-median difference analysis of partisan bias?
A. I'm going to try to remember as best I can, I'm going to qualify again by saying it's been a while.
Q. That can be a running stipulation, but go ahead.
A. I'm going to do my best here.
My best recollection right now is that I did not report on the mean-median. That's to the best of my recollection.
Q. And how about the efficiency gap?
A. My recollection is that I did calculate the efficiency gap of the enacted and in some simulated plans in that report.
I'm not recalling that I calculated the efficiency gap for all the simulation, for all sets of simulations. But I do recall doing that calculation for some simulations and perhaps not for others.
That's the best of my recollection.
Q. Do you have any decisional criteria or policy about when you'll use the mean-median difference and when you will use the efficiency gap?
A. I'm not sure exactly what you mean by decisional criteria.
Q. Well is there -- I take it from your answers you don't always do both mean-median and efficiency gap, and I'm wondering if -- why you choose one over the other in certain

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circumstances.
A. Oh, well in some cases I choose metrics because -- or I employ metrics because I'm trying to respond to questions that are put forth to me by counsel. So that certainly is part of how I decide what metrics to use. It depends on what questions are put forth to me.
Q. So you'll use the measure of partisan bias suggested to you by the Plaintiffs' counsel?
A. Well I try to answer questions that are put forth to me. And if those questions are answerable by metrics that I find to be appropriate, then I will do so.
Certainly it's not the case that I will employ a particular metric simply because a lawyer tells me to do so. But if a lawyer asks me to answer a question, that I believe can be answered by an appropriate measure, then I'll certainly do so, or at least evaluate the feasibility of doing so.
And I would add on top of that, I guess, that certainly it's not been the case that all of these measures have been -- have been widely used or even known by me during my entire career of writing -- or my entire period of writing expert reports. And certainly the efficiency gap is one example of that.
Q. Of what?
A. Oh, of a measure not being available to me.

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For example, in 2013 I wrote an expert report in which I didn't use the efficiency gap because there had been no academic literature in political science really discussing the efficiency gap. So I just wasn't even aware of the formula back then.

So that's just an example of what might go into my decision making.

Q. What about since Stephanopolous and McGhee articulated the efficiency gap in the Chicago Law Review and elsewhere, was it known to you then?

A. You mean when that article was written, was it then known to me?

Q. Yes.

A. Well I was generally aware that the article was being published, so of course I was aware of generally what they were describing in that article.

Q. Okay. And then the rest of these cases -- I'm going to try to get through this as quickly as I can.

There is about three cases if you look at page one where the, that are in Florida where Detzner is the defendant, okay? For example, it says --

A. Yes.

Q. -- Romo v Detzner, League of Women v Detzner. I believe there is one other.

Are those all the same cases, or are those

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different cases?

A. Okay. You're talking about Rene Romo versus Detzner and then League of Women Voters versus Detzner.

Q. Right.

A. Okay. My recollection is that those were different cases. Those were different districting plans that were being challenged.

Q. And what was the difference?

A. Let me try and remember. Those two cases in fact do have similar names so I'm going to try to keep it straight here.

I believe, I'm going to try my best here, to my recollection, the Rene Romo versus Detzner case was a challenge of Florida's then enacted -- then just enacted congressional districting plan. And then my recollection is that the League of Women Voters versus -- of Florida versus Detzner case was a challenge to the then enacted Senate -- State Senate plan.

Q. And how about Corrine Brown v Detzner?

A. Okay. I see that one. I believe that that was a case in which Congresswomen Brown challenged the -- challenged something to do with a specific -- a specific congressional district or a set of congressional district lines that obviously involved her congressional district. So it was a congressional challenge.

I don't recall it being -- I don't believe it was a

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statewide challenge.

Q. Okay. Well let's start with Romo, did you testify on behalf of the plaintiffs in that case?

A. I was deposed, I did not testify at trial.

Q. But did you appear on behalf of the plaintiffs?

A. Did I --

Q. Did you offer a report for the plaintiffs?

A. I authored a report, yes, sir. Sorry.

Q. What was the gist of that report?

A. Okay. That was a report in which I had conducted a number of -- first I had evaluated the enacted plan in terms of partisan, its partisanship. And then I had analyzed a number of various sets of computer-simulated plans that were simulating Florida's congressional districting planning and I evaluated the partisanship of those.

Q. And how about the League of Women Voters, what was the gist of your report in that case?

A. In the League of Women Voters versus Detzner case, I analyzed the partisanship and the racial composition of various -- I believe I analyzed the partisan composition of the entire Senate plan. I analyzed the racial composition of various districts.

And then I performed some number of simulations, I believe more than one set of simulations using differing -- differing configurations of districts that were held frozen.

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And I analyzed the partisanship, and I recall that I analyzed the partisanship of those simulated plans.

Q. Okay. And then in Brown?

A. In the Corrine Brown versus Detzner case -- you're asking what I did in my report, right?

Q. Yes.

A. Okay. I believe I wrote one report, that's my recollection. And in that report I produced data looking at the partisanship -- I believe using, looking at the voter -- using the voter registration files looking at the partisanship, and possibly the racial composition of one or more congressional districts.

Q. Did you run any simulated plans in that report?

A. I did not produce any computer-simulated plans.

Q. And in all of those cases the plaintiffs were challenging a redistricting plan enacted by a Republican legislature?

A. To the best of my knowledge, the Florida legislature was Republican -- was unified Republican controlled during the time of redistricting at the beginning of this decade.

So I believe that is an accurate characterization, to the best of my knowledge.

Q. And the plaintiffs in Romo and League of Women Voters were alleging that the Republicans had engaged in an antidemocratic gerrymander, correct?

A. I can't speak to that. I can tell you that the plaintiffs

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were challenging districting plans that had been enacted.

Q. On what grounds?

A. Which case are we talking about now?

Q. I'm trying to put together Romo and League of Women Voters.

A. Okay.

Q. If there is a difference, let me know.

A. There might be, I am not sure. I'll have to think about this.

My best -- to the best of my knowledge, Romo was purely a partisan challenge. To my knowledge, I don't -- I'm not aware of the Romo plaintiffs alleging racial gerrymandering.

Q. How about League of Women Voters?

A. To the extent that I'm aware, I'm not aware of the League of Women Voters of Florida alleging anything other than a partisan bias in the redistricting. I'm not aware, for example, that they made a racial challenge.

Q. Just to be clear, they were alleging a partisan bias against Democrats?

A. I'm not sure that they characterized it that way. And I'm just not going to speak for the League of Women Voters, plaintiffs.

Q. Which party was disadvantaged according to the plaintiffs in the League of Women Voters, Democrats or Republicans?

A. Well I can tell you about my findings. And certainly I

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analyzed things in terms of a Republican or Democratic bias. And I'm happy to characterize my own findings as there being a partisan bias that favored the Republicans.

Q. Okay.

A. I'm just saying -- all I'm doing is I'm saying I'm not going to speak for the plaintiffs themselves.

Q. Have you ever been involved in a case where you allege that there was a partisan bias in favor of Democrats?

A. If I could ask you to repeat the question.

Q. Have you ever been involved in a case where you concluded or alleged that there was a partisan bias in favor of Democrats?

A. I can't recall doing that.

Q. Okay. And you're a Democrat?

A. You're asking about me personally?

Q. Yes.

A. I'm not.

Q. You are not a registered Democrat?

A. My understanding is that in Michigan we don't have partisan registration.

We don't have -- my understanding is that Michigan does not allow voters to register as a member of a particular party.

Q. Would you align yourself with the Democratic or Republican party in your voting practices?

A. Neither.

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Q. Okay. Georgia State Conference of the NAACP versus State of Georgia, that's a 2017 case --

A. Well --

MR. YEAGER: Wait, let him ask a question.

MR. CARVIN: That's fair.

THE WITNESS: I see that case.

MR. YEAGER: Wait, Jowie, let him ask the question, then you answer.

BY MR. CARVIN:

Q. I take it from the pause that you have seen this case listed now on page one of your report, correct?

A. Yes, sir.

Q. Okay. So now, what was the issue in that case, and what was the gist of whatever report you authored in that case?

A. Okay. Sure.

To my knowledge, that case is one in which plaintiffs are challenging the drawing of two State House districts, District 105 and 111, in Georgia's state legislature, State House.

Q. And on what grounds are they challenging that?

A. I'm going to do my best to answer the question. I think this is part of the dispute in that case so I'm just going to do my best to -- and I'm not legally qualified to accurately characterize these sort of cases.

But my understanding is that the plaintiffs are

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alleging racial considerations in the drawing of House Districts 105 and 111.

Q. And what, if anything, have you analyzed in that case?

A. I conducted analysis of the voting patterns in those two districts, which are parts of Gwinett County and Henry County.

I looked at voter registration numbers and analyzed voting patterns in terms of candidates preferred, as well as racial -- the racial composition of the electorate, of the turnout of the electorate.

And I performed a model -- I may have used the term simulations, but it's still in the sense that I've been discussing simulations here, a model predicting what would have happened in a hypothetical district using voter registration records.

Q. And what was your conclusion?

A. In general my conclusion was that had the two districts that were being challenged, 105 and 111, had they not been redrawn in the way that they were in the middle of the decade, that the election outcomes may well have been different than they actually were.

Q. Different in terms of party or --

A. Different in terms of the candidate who won.

Q. And were you analyzing whether that candidate was the preferred candidate of choice of the black community?

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A. I did. I analyzed racially polarized voting --
Q. Right.
A. -- in my report.
Q. And your conclusion was that prior to the re-draw, the black preferred candidate would have been successful; but after the re-draw, he would not have been, or she would not have been?
A. That was generally my conclusion.
Q. Okay. And where is that at this point? Has there been a trial?
A. That case, to my knowledge, has not gone to trial.
Q. Okay. Have you submitted a report?
A. I have. I wrote a report.
Q. Have you been deposed?
A. I have.
Q. Okay. And NAACP versus St. Louis?
A. Actually let me just make sure that my report was correct in describing my involvement in that case.
So I listed that Georgia case as one in which I've written an expert report, and as I said, I've been deposed, but have not -- did not -- there has been no trial in which I have testified in that case.
I just wanted to make sure I was describing that accurately.
Q. Okay. And then at the very top you have Missouri National Association for the Advancement of Colored People versus

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Ferguson and St. Louis County Board, and that was in 2014. Do you see that case?
A. Yes, sir.
Q. Okay. And what was your analysis -- what issues did you analyze in that case?
A. I was a co-author on a, I believe it was a rebuttal report in which I helped to -- I did some statistical analysis in which I helped to analyze, I recall, the racial composition of a districting plan that I believe had been proposed.
That's all that I can specifically remember being my work in that case.
Q. Was the issue again racial block voting?
A. I'm not sure I know enough to characterize it as that, but I do recall it involved racial issues.
Q. Okay. If you could turn to the second page of your report, please. I'd like to direct your attention to footnote one.
A. Yes, sir.
Q. Okay. You say here, you reviewed the statutory criteria and applied the criterion mandated in these statutes to produce a set of alternative maps for Michigan's Congressional, Senate and House districting plans.
To your knowledge are those the plans that were attached to Plaintiffs' complaint in this case?
A. Let me just review where I -- where this footnote starts.
MR. YEAGER: While he's reviewing, I'm going to

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object to the extent that the question requires him to disclose conversations with counsel that would be protected by Rule 26 and Work Product Doctrine.
You may answer.
THE WITNESS: My recollection is that what I'm referring to in this footnote, and when I'm saying alternative maps, I'm talking about the simulated plans that I produced in this report.
BY MR. CARVIN:
Q. So you draft a footnote, you're referring to all 3000 simulated plans?
A. That's my recollection of what I meant by that phrase, by that footnote.
Q. Did you ever prepare one map for Congress, one map for Senate, and one map for the House, by yourself?
A. Oh, by hand? Personally?
Q. No. Did you either select among the thousand or create your own map?
A. Well --
MR. YEAGER: Okay, wait. Just wait.
I'm going to object. We'll have to go through this a little bit at a time.
The witness is instructed not to testify as to his conversations with counsel, which are protected by Rule 26 and the Work Product Doctrine, or other work that he did

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that's not reflected in his report for the same reason.
THE WITNESS: Okay.
MR. YEAGER: Go ahead. With that constraint, answer to the extent that you can.
THE WITNESS: Okay. And I'm just going to ask you if you could please reask your question.
BY MR. CARVIN:
Q. Did you produce maps, individual maps to Plaintiffs' counsel and/or Professor Mayer?
MR. YEAGER: Same objection and instruction.
THE WITNESS: I'm going to follow Plaintiffs' counsel's instruction.
BY MR. CARVIN:
Q. No, you're going to answer the question.
MR. YEAGER: Okay, hold on. Do you want to take a break and talk about this?
MR. CARVIN: We can do it on the record. We can do it on the record.
MR. YEAGER: Okay.
MR. CARVIN: You attached three alternative maps to your complaint.
MR. YEAGER: Yes.
MR. CARVIN: Professor Mayer has already testified that Professor Chen drew those plans. He also testified that Professor Chen forwarded those plans to him.

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You stated in the deposition that those were the plans that were attached to Plaintiffs' complaint.

I'm simply trying to confirm that reality which is already out there and certainly can't be hidden from the Court.

MR. YEAGER: Okay. First of all, if you want to play games about hiding things from the Court, that's clever, but not appropriate, number one.

Number two, that -- you've not correctly summarized the prior testimony, I object to that.

And number three, the witness is going to answer to the extent it's not protected, just as Professor Mayer did.

Now if you want to narrow your question to something that is not protected, the witness will answer.

MR. CARVIN: I'll go back to where I started.

BY MR. CARVIN:

Q. Are the maps that you -- are you aware of alternative maps being attached to Plaintiffs' complaint?

A. I am generally aware of that.

Q. Did you prepare those maps?

THE WITNESS: What are my instructions?

MR. YEAGER: You can answer that yes or no, to the extent you know.

THE WITNESS: Okay. The answer is that to the best of my recollection those plans were produced by computer

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simulations that I programmed.

BY MR. CARVIN:

Q. But there was only one map for each office attached to Plaintiffs' complaint, correct, not a thousand?

A. That is my understanding.

Q. Okay. Did you select the one map for Congress, the one map for Senate, and the one map for the State House that was attached to the Plaintiff's complaint?

MR. YEAGER: Objection.

You can answer that yes or no.

THE WITNESS: I did not make that selection.

BY MR. CARVIN:

Q. Did you -- well then I'm confused. They were -- you didn't select among the thousand?

MR. YEAGER: You can answer that yes or no.

THE WITNESS: I did not make the selection.

BY MR. CARVIN:

Q. Who made the selection?

THE WITNESS: Can I answer the question?

MR. YEAGER: Well the objection is the same objection about matters protected by Rule 26.

I'd like to take a break and talk to the witness to find out what he knows and doesn't know, so that he can answer your question the best that he can.

MR. CARVIN: All right.

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(At 10:20 a.m. went off the record.)

(At 10:26 a.m. went on the record.)

MR. CARVIN: Back on the record.

BY MR. CARVIN:

Q. Who chose the alternative maps that were attached to Plaintiffs' complaint?

MR. YEAGER: You may answer that question, to the extent you know.

THE WITNESS: My understanding is that Plaintiffs' counsel did.

BY MR. CARVIN:

Q. Okay. Did you have conversations with him about which map to choose?

MR. YEAGER: You can answer that yes or no.

THE WITNESS: I did not have conversations regarding what map they were going to choose.

BY MR. CARVIN:

Q. Did you play any role in selecting the map that was attached to the Plaintiffs' complaints?

MR. YEAGER: You may answer that yes or no.

THE WITNESS: Yes, I did.

BY MR. CARVIN:

Q. What was that role?

MR. YEAGER: So I'm going to object to the extent that that would require you to disclose communications

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between you and us; but to the extent that you can answer the question without referring to communications between us, you may answer the questions.

Do you want to hear it back again?

THE WITNESS: Please give me your instructions again.

MR. YEAGER: Okay. You may answer the question to the extent it does not require you to disclose communications between you and Plaintiffs' counsel. To the extent it does not require a disclosure of the content of those communications, you may answer.

THE WITNESS: I'm going to do my best to answer as much of the question as I can, while still following Mr. Yeager's instructions that he just gave to me. So I'm going to do my best to follow both of those things.

So my answer is that I produced a number of computer-simulated plans.

Now I can't answer any further without violating Mr. Yeager's instructions to me. So I'm going to follow Mr. Yeager's instructions to me by stopping right there.

MR. YEAGER: And let me clarify my instruction in a way that might make this easier.

To the extent that you could answer further without disclosing the content of communications between us, you may answer further.

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THE WITNESS: I've answered as far as I can while still following Plaintiffs' counsel's instructions to me.
BY MR. CARVIN:
Q. Completely unacceptable.
MR. CARVIN: I'll try it another way. I'll ask you, Mr. Yeager.
Who produced the maps that you presented to the Court as part of your complaint?
MR. YEAGER: Well I'm not going to be deposed in the deposition. I'm pleased to have that conversation with you, but we're not going to have it on the record in a deposition.
MR. CARVIN: I'm not going --
MR. YEAGER: And we can have that conversation right now if you prefer. We're not going to have it on the record in a deposition.
MR. CARVIN: Okay. Let's go off the record for a minute.
(At 10:30 a.m. went off the record.)
(At 10:47 a.m. went on the record.)
MR. CARVIN: Back on the record.
BY MR. CARVIN:
Q. I'm going to try to get through this without putting you in an awkward spot in terms of your communication with counsel. I'm not entirely sure where we left off when we were talking.

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So let me just ask you a couple of questions. To the extent you can answer them without referencing consultation with counsel, you can tell me -- you can tell me that you got that problem. But if you can answer it without referencing that, I'd appreciate it if you did. I think this will be clear once I ask the question.
A. Okay.
THE WITNESS: And if I could just ask, Mr. Yeager, are my instructions the same as before that I am not to reference -- are you instructing me not to answer any questions with reference to conversations with Plaintiffs' counsel.
MR. YEAGER: Well we're going to go question by question. So let's just listen to the question --
BY MR. CARVIN:
Q. Mr. Yeager is right. I apologize for interrupting. I don't think this will be an issue as I --
THE WITNESS: Or are my instructions to wait for you?
MR. YEAGER: You have no instructions until you get a question; and then if instructions are needing to be given, you can count on me.
THE WITNESS: Great.
BY MR. CARVIN:
Q. Okay. So did you play any role in selecting the alternative

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maps that were attached to the complaint?
MR. YEAGER: You can answer that question.
THE WITNESS: I produced a number of simulated maps.
BY MR. CARVIN:
Q. Okay. In your report obviously you produced -- let's use Congress as an example, you produced a thousand alternative maps for Congress?
A. Yes, sir.
Q. Is that, when you say you produced a number are those the maps you're referring to?
A. Yes.
Q. Okay. One map was attached to the complaint. Do you know --
A. Oh, let me actually go back and clarify my answer if I could.
MR. YEAGER: Go ahead.
THE WITNESS: So you are correct in that I produced one thousand congressional maps and obviously one thousand Senate maps and one thousand House maps.
Even before, I recall as early as 2016, I had already -- I had already produced a, also a number of maps, I recall of the House and Senate plans. I don't recall the Congressional plans. But I had produced already a large number of House and Senate maps.
BY MR. CARVIN:
Q. In connection with this litigation?

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A. They were -- back in 2016 I was just first producing draft simulations.
Q. But why?
MR. YEAGER: Can I just comment?
MR. CARVIN: Yes.
MR. YEAGER: We had engaged him. He was doing preliminary work that led to this case.
MR. CARVIN: That's what I'm trying to figure out.
BY MR. CARVIN:
Q. When you say a large number, for example, how many -- in the rough neighborhood how many House maps did you produce?
A. Definitely over ten.
Q. Okay.
A. I don't recall, and certainly didn't keep record of --
Q. Were those ten produced pursuant to the same algorithm that you later used for the one thousand?
A. No. An earlier draft.
Q. Okay. An earlier draft of the algorithm?
A. To my recollection, when I started out I went through multiple drafts, and went through structural changes. And so certainly I had produced, using earlier drafts of my simulation algorithm, a number of House and Senate plans.
Q. When you use the word draft, do you mean draft simulation algorithms or draft actual maps?
A. Both.

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Q. Okay.
A. In other words, the simulation code, in the draft form, produced maps in draft form.
Q. But you subsequently made changes to the simulation algorithm which produced different maps. Do I understand that correctly?
A. Correct.
Q. Okay. And at the end of that process you had roughly, say, ten maps for the House?
A. I don't want to say it was roughly ten, I definitely recall at least ten. I just didn't keep a record, and it was such a long time ago.
Q. Okay. To your knowledge, were those maps attached to the Plaintiffs' complaint?
A. I have no idea.
Q. Okay.
A. Wait, let me think about that. I want to think about whether I know the answer to that.
Your question was to my knowledge, were they attached to the Plaintiffs' complaint?
Q. Right. I don't want to wordsmith here.
Do you know if the maps that were attached to the Plaintiffs' complaint were among the maps that you had produced in 2016?
A. I don't know.

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Q. Okay. Do you know if they came from the one thousand simulated maps that you produced pursuant to your algorithm?
A. I don't know.
Q. Okay. What if anything do you know about the maps that were attached to the Plaintiffs' complaint?
THE WITNESS: What are my instructions?
MR. YEAGER: You're asking about the maps that were attached to the complaint?
MR. CARVIN: Yes.
MR. YEAGER: I believe the witness can answer this question without invading work product or Rule 26 protection.
So my instruction to you is to answer the question.
If you believe your answer is going to require you to disclose communications with counsel, other than just providing maps, then don't answer that and we can discuss what you may need.
Within that constraint, you may answer.
THE WITNESS: Okay. I'm going to do my best to answer your question while following Mr. Yeager's instruction to me, which puts some limits on how I can answer here.
So to my knowledge, I produced a significant number of maps, definitely over five or ten. And to my knowledge, some of those were attached to Plaintiffs' complaint.
BY MR. CARVIN:
Q. Okay.

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A. That's the best of my knowledge.
Q. And just to be clear, the maps you just referred to, were those among the thousand simulated maps or did they precede the production of those?
A. You're asking about the maps attached to Plaintiffs' complaint.
Q. Yes.
A. I don't know.
Q. Okay. Do you know whether the five to ten or whatever it was were among the thousand?
MR. YEAGER: Objection, vague, ambiguous.
You may answer.
THE WITNESS: I think by five and ten, you're referring to the draft maps that I was talking about from back in 2016.
BY MR. CARVIN:
Q. The ones you just referenced in your answer.
A. Yeah, I think I know what you're talking about, you're talking about early drafts. And that's why I described them as early drafts.
I certainly went through drafts of the algorithm and then made more changes and started all over again, and ultimately produced one thousand. So I'm talking about two different sets, separate maps.
Q. I know you did. But you also said there was a smaller subset

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that you had produced as well. Right?
You used the phrase five to ten a minute ago.
A. I was talking about the same thing. I mean the point is that I produced draft maps, draft simulation algorithms years ago, produced some maps; and then later on, produced one thousand for the purpose of the three sets in my report.
Q. Just to clarify for the record, I'm now talking about, say, the Congressional map that was attached to the complaint, was that among the draft maps that you had prepared?
A. Okay. I gotcha. I apologize for misunderstanding the question.
And the answer is that I don't know.
Q. You've never reviewed the maps that were attached to the complaint?
THE WITNESS: What are my instructions?
MR. YEAGER: You can answer that.
THE WITNESS: I can answer that even by making reference to communications with Plaintiffs' counsel? What are my instructions?
MR. YEAGER: Okay. Now the witness has expressed a concern about that communication so we're going to have to take a break so I can figure out what it is and figure out if he can answer the question that's on the table.
(At 10:55 a.m. went off the record.)
(At 11:00 a.m. went on the record.)

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MR. CARVIN: Back on the record.
BY MR. CARVIN:
Q. What if anything do you know about where the alternative maps attached to Plaintiffs' complaint came from?
A. My understanding is that they came from maps that I produced.
Q. And do you know whether the maps you produced were among the thousand simulated maps, or were they perhaps different, as far as you know?
A. You're talking about the maps -- about the complaint maps?
Q. Yes.
A. I don't know. I don't know for sure the answer to that.
Q. Okay. Fair enough.
Did you read Professor Mayer's report?
A. No, sir.
Q. Okay. Do you know that he referenced demonstration plans?
A. I have been overhearing conversations between you and Mr. Yeager this morning, and I gathered that was the case.
Q. So do you know whether or not the demonstration plans are different from the maps attached to the Plaintiffs' complaint?
A. To my knowledge, I have not -- well, I have not seen Professor Mayer's report, so that's not something I can say for sure. I've just not seen his report.
Q. Fair enough. So you don't know if any similarity or lack of similarity between the demonstration plans are analyzed in

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Professor Mayer's reports and the maps produced, attached to the complaint?
A. I have not reviewed the maps that Professor Mayer apparently reviewed in his report. I haven't seen the report. So I don't know what maps those are. I wouldn't have any basis for being able to answer that.
Q. For the same reason, I take it, you don't know the genesis of the plans in the Mayer report?
A. Not being able to identify those maps, I can't say for sure.
Q. Okay. Are you aware of any transmittal of maps to Professor Mayer?
A. Am I aware of any transmission of maps?
Q. Yes.
MR. YEAGER: To Professor Mayer?
MR. CARVIN: Correct.
THE WITNESS: From me or from Plaintiffs' counsel?
BY MR. CARVIN:
Q. Just anybody.
A. I can speak for myself. I have never transmitted any maps to Professor Mayer by myself.
Q. I really think this is just a clean-up question. You've testified that you haven't seen the demonstration plans, you haven't read the Mayer report. I'm going to assume from that that you don't know who gave him the plans or anything about the plans.

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Is that a fair assumption?
A. That is correct. I'm just saying I didn't transmit to him any maps.
MR. CARVIN: Counsel, we did have a discussion earlier. Can you make any representation about where the demonstration plans came from, and whether they're different from the Plaintiffs' alternative map?
We are going to make quite an issue of this, if -- but you can clarify the situation if you want.
MR. YEAGER: Well I'm not going to do it on the record in this deposition. I'll be glad to do it in some other appropriate format.
I know there is some outstanding discovery about this. I'm having e-mails right now with your co-counsel regarding files for the maps that we've produced. And you and I did have that conversation.
If there is something, a particular fact that you want stipulated, I'll consider that.
MR. CARVIN: Okay. Yes. What we'd like you to stipulate to is that the demonstration maps were either provided by you and/or are different from -- the same as or different from the alternative maps.
What I'm trying to figure out is are the alternative maps attached to the complaint different than the demonstration plans in Mayer's report.

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MR. YEAGER: As I've told you, those two sets are not identical. They may not be -- there may be some overlap.
MR. CARVIN: Okay.
MR. YEAGER: I'm just not aware as I sit here because I haven't gone back and reviewed them since you raised that issue this morning. Again that's all in the materials that have been provided.
But that's the answer to the question.
MR. CARVIN: And that's fair. And I'm assuming from Professor Chen's answer that since he wasn't the source of the provision to Mayer, and Mayer didn't produce the maps, without revealing any confidences, those were provided by Plaintiffs' counsel to him.
Is that fair?
MR. YEAGER: I'm sorry, I'm distracted.
Would you read that back?
(Record read: Q. And I'm assuming from Professor Chen's answer that since he wasn't the source of the provision to Mayer, and Mayer didn't produce the maps, without revealing any confidences, those were provided by Plaintiffs' counsel to him.
Is that fair?)
MR. YEAGER: The maps that Professor Mayer attached to his report were provided by Plaintiffs' counsel.
MR. CARVIN: Okay. Thank you.

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BY MR. CARVIN:
Q. All right. Hopefully we're not going to get into another sticky discovery issue, but let me wade in here as well.
Have you provided Defendants with the source code from which -- well the source code for the use for the thousand simulated maps?
A. The simulated maps in my report is what you're referring to?
Q. Yes.
A. And I have provided to Mr. Yeager, or to Plaintiffs' counsel, a draft code that is substantially the same as the code that I ultimately used --
Q. Okay.
A. -- to produce.
So it is structurally identical to the ultimately compiled code that I used to produce the three different sets of simulations in my report.
Q. Where is the code that you ultimately used?
A. The code that I ultimately used was a .JAR, it's a compiled .JAR file. That's how I ultimately run simulations.
Q. Where is that .JAR file?
MR. YEAGER: That was produced.
THE WITNESS: And well I'll just explain that I believe back in June Mr. Yeager asked me to produce that .JAR file. And I went back and identified I believe it was three different .JAR files, I can't remember if it was three sets

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of code that were compiled into one .JAR file, but I gave those to Mr. Yeager.
BY MR. CARVIN:
Q. Right. But in addition to that you provided a source code that you say is substantially the same as your final source code, correct?
A. A draft code, a draft source code of the three sets of simulations.
Q. Okay.
A. That is substantially the same.
Q. All right. Where is the final draft code?
MR. YEAGER: Objection, vague and ambiguous.
BY MR. CARVIN:
Q. Are you really confused by this?
MR. YEAGER: When you say final draft code --
BY MR. CARVIN:
Q. You said you provided a draft code that was substantially the same as the final?
A. Yes.
Q. Okay. Where is the final?
A. That basically is the final draft code. It is structurally the same as what I actually ran.
Q. Okay. And you have that, and you were able to provide that to us, correct, the one that's substantially the same?
A. Yes, sir.

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Q. Okay. We want the one that is not substantially the same, but is the one that was actually used. Can you provide that to us?
A. I save draft code as I make changes to it. And I went back and looked, and that, to the best of my recollection, and as far as I can tell, is essentially identical. It is identical in structure to the simulations that I ran.
Q. All right. But why do you have to give us one that's substantially the same. Why not give us the one that produced the simulations? Is it not available?
A. I don't save every single change that I make.
Q. Okay.
A. I save changes from time to time.
Q. Did you not save these?
A. I did. I made -- I saved it in its -- in its form before I ran the simulations, in the same structural form before I ran the simulations.
Q. Right. But then you ran the simulations; can you give us the source code for the actual simulations that were run? Did you save them?
MR. YEAGER: Asked and answered.
You may answer.
THE WITNESS: As I said, I turned over, number one, the actual compiled code.
BY MR. CARVIN:

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Q. Right.
A. That I identified.
Q. Right.
A. And then I turned over the uncompiled draft code in the, substantially the same form as I identified it.
Q. Right.
A. Before producing that compiled -- that compiled JAR file.
Q. Right. And can you give us the one that's not in substantially the same form, but the one that was actually used?
A. I did.
Q. No. All right.
You didn't produce the source code that actually relates to the actual simulations, right? You produced one that you say is substantially the same and functionally identical.
MR. YEAGER: Objection, misstates the testimony.
You may answer.
THE WITNESS: I didn't hear the question.
BY MR. CARVIN:
Q. Why don't you tell me what you gave to us in your own words that was substantially the same.
A. Oh, you're asking what that is?
Q. I'm asking you why you have to give us something that's substantially the same as opposed to the actual.

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A. Because that's the only draft code that I've got.
Q. And that's why I'm asking. Did you delete it?
A. No.
Q. Did you not save it?
A. I just did not save every single iteration or every single word that was changed in the code. I only save code when there is a structural or substantial change made.
So I don't change -- I don't save a draft copy of the code after every single function that's added or every single command that's added.
Q. And --
A. I think I understand your question, the answer is it just doesn't exist. It never existed.
Q. Because you didn't -- well it existed to run the simulations.
A. I never saved it is what I'm saying --
Q. Right.
A. -- when I say it never existed.
Q. And you're saying that it's not automatically saved?
A. No. It's not like Microsoft Word where there is something like an autosave function that automatically saves every 30 seconds or something like that.
Q. Or using Java code?
A. Oh, I write code in Java.
Q. And doesn't that automatically save?
A. Like I said, no. There is no autosave.

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Q. Is that your testimony?
A. Well, okay. I'll say this is my testimony to the best of my knowledge.
There may well be some kind of Java compiler out there that does in fact have an autosave function by default. I'm not specifically aware of it and certainly I haven't used any such thing before.
But in my practice, the way that I write Java code for my research, I don't use any sort of software or any sort of compiler that has an autosave function.
Q. All right. You say they were substantially the same. How did they differ?
A. Sure. I went back and looked at the various drafts of my Java code that I had actually saved and I identified this one draft as being substantially the same. But I could see that there were cosmetic changes, there were cosmetic differences that I would -- that, to the best of my recollection, I certainly would have taken out, simply because they're not part of the essential structure of the simulation.
So these are cosmetic things that I certainly would not have wanted to really be running in part of the final code because they're cosmetic.
Q. Okay. Can you describe that, what you took out?
A. Yeah. I'll do so to the best of my recollection. But like I said they're all cosmetic changes.

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So I'll give an example. When you run Java code, you have a console that can display output. It's just, say, numbers or text that pops up on the screen. And it tells you about the progress, or the status of various variables or various functions, or various classes that are going on in the code.
So it's just kind of like a status update. To put it in the form of analogy, it's like if you download a huge file from the internet, you might have a window that pops up that says it is 98 percent finished or 58 percent finished, like status update. Those are things that have no meaning, other than displaying the status of a process on the console for the screen to display.
Now obviously that doesn't affect the structure of any of the simulations.
So that's -- some of those are redundancy checks, some of those are just for the sake of being able to check for the proper running, to check to see how fast the processes are running. But they have no essential structure in the simulation algorithm.
And so, for the purposes of producing a large number of simulations, you don't want -- I'm going to speak for myself, I certainly don't want those taking up processing power, taking up RAM.
So those are things that are cosmetic, just are not

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helpful, and are just going to slow things down. So that's the sort of cosmetic thing that I'm talking about.
I could give you some more examples if you'd like to but I'm just trying to explain what I mean when I say cosmetic.
Q. Did you add or subtract any functions?
A. I subtracted those cosmetic things.
Q. And what does cosmetic mean in this context?
A. Okay, sure --
MR. YEAGER: Asked and answered.
You may answer.
THE WITNESS: I think I was just trying to answer that with your previous question. I'll try again, so I apologize if I'm repeating myself here.
What I mean by cosmetic changes is changes that are removing things that are not essential to the structure or functioning of the algorithm.
So an example is like I was saying a minute ago, when you have to run Java code, there is a console, and that console can display text or numbers. And so there are various lines of codes that will, say, display the value of a particular variable, display the progress for a particular class that's running, display something that's going on.
Those aren't actually helping to create a simulated plan, those are just kind of like status updates.

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The example I gave you a second ago is you download a file of the internet, a window pops up and says 58 percent of the file has downloaded, downloading still in progress. That's just kind of an analogy.

BY MR. CARVIN:

Q. Right.

A. But these are cosmetics things. That windows that pops up that tells you 58 percent of the file is downloading, that's not actually -- that's not actually part of the structure of downloading the file. It's just updating the console, updating the window telling you that it has made a certain amount of progress.

That's what I mean by cosmetic.

Q. Right. And the version you provided to us will have those cosmetic functions in it?

A. To my knowledge, I looked in that draft code, and I saw -- I saw some number -- a substantial number of those kind of cosmetics things.

Q. And your testimony is the only difference between what you've provided to us and what went into producing the actual simulated plans, is those cosmetic functions?

A. Yes. I saw lots of these cosmetic things that I definitely would have taken out. And to the best of my knowledge, those were the changes.

Q. But you can't provide us when you made those changes because

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you chose not to save them?

A. It's just not my normal practice to save after only purely cosmetic changes. Let me just state that more clearly. I don't think all the words got out there.

It is not my normal practice to save drafts of my Java code after every single cosmetic change that makes no substantial or structural change.

Q. Right.

A. I only save -- I generally save drafts of my Java code, to my recollection, when I made structural, substantial changes.

Q. And it's your testimony that Java does not save these drafts automatically as far as you understand?

MR. YEAGER: Asked and answered.

You may answer.

THE WITNESS: Same answer as before. Obviously I'm not going to testify that I know about all the different Java compilers that there out in the world and what different Java programmers might use or not use.

I'm just telling you from my own personal experience and my own personal practice, I do not employ and have never used a Java compiler that has that sort of autosave function that you're describing.

If it's there, I don't know how to use it. I've never made it a practice to do so. But to my knowledge, I don't know how to.

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I'm just saying that I don't know how to activate an autosave.

BY MR. CARVIN:

Q. What did you use?

A. I'm sorry?

Q. Java code, what did you use to run these simulations?

A. I used Java code.

Q. And your version of Java code doesn't automatically save different iterations?

MR. YEAGER: Asked and answered.

You may answer.

THE WITNESS: I think what I said a minute ago was I don't have a Java compiler or anything on my computer that, to my knowledge, autosaves Java code.

BY MR. CARVIN:

Q. Okay. In the litigation in North Carolina, did you produce your final source code, in the litigation, do you know?

A. My recollection is that I produced .JAR compiled Java code file.

Q. Right. But the uncompiled source code?

A. In the North Carolina case?

Q. Yes.

A. No.

Q. Okay.

A. My recollection is no.

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Q. How about in Pennsylvania?

A. My recollection is no.

Q. Okay. In any case have you ever produced your final source code?

A. You're talking again about the uncompiled source code?

Q. Yes.

A. And my recollection is, no, except that sometime last month Mr. Yeager asked me to look through and identify draft, uncompiled source Java code.

Q. Has anyone beside you ever seen the final source code for any of these analysis that you produced in any of these litigations?

A. To my knowledge, yes.

Q. Who?

A. I'm going to do my best to answer the question, but obviously I'm going to qualify that I couldn't possibly know an exhaustive list.

So certainly I know -- I recall that there have been -- I recall that there was an expert hired by the Defendants in the North Carolina Rucho case that testified that he reviewed my Java code, the .JAR file that I turned over.

Now that was his testimony. Obviously I'm saying I'm just taking his word for it. I don't know whether he actually did or not. But to my knowledge he testified that

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he did.
Q. How did he obtain it?
A. I'm sorry?
Q. How did he obtain it, in North Carolina?
A. How did he obtain that .JAR file?
Q. Oh, now you're back to the .JAR file, right?
A. Yes.
Q. Okay. The compiled?
A. Yes.
Q. But nobody has ever seen the uncompiled final source code, right?
A. Okay. In -- let me just go back and explain what I was saying about the North Carolina case.
As I said, I turned over a .JAR file in the North Carolina case. And the expert that I was just referring to, to my knowledge, he testified that he had reviewed that, and testified to some things about it, gave his opinion about it.
I do not recall -- to my knowledge, I did not turn over uncompiled code because I wasn't asked to.
Q. Okay. So again as far as you know, nobody, except you, in any of these litigations on the opposite side of the litigation has ever seen your uncompiled final source code, right?
A. Not to my knowledge.
Q. Okay. Did you have any health issues between June 1st and

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mid August of this year?
A. Yes.
Q. What was that?
MR. YEAGER: I'm going to object.
BY MR. CARVIN:
Q. I'm going to give you some relevance because obviously this is an atypical question, and I don't want to get involved in your personal privacy.
Was there any health issues which prevented you from rapidly responding to discovery requests or providing the kind of code that we've been discussing between, say, June 1st and mid August?
MR. YEAGER: I'm going to let him answer that question, but just to protect his private health information, I'll just ask you to answer yes or no and then we'll go on if counsel would like to go on.
BY MR. CARVIN:
Q. Just to reinforce Mr. Yeager's point, I'm not at all interested in your health issues and I understand the privacy concerns.
I'm wondering if this was a factor in any potential delays in responding to our discovery requests?
MR. YEAGER: Could you just read back the question that's on the table?
(Record read: Q. Was there any health issues

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which prevented you from rapidly responding to discovery requests or providing the kind of code that we've been discussing between, say, June 1st and mid August?)
MR. YEAGER: I think the witness wants to consult with me on answering that question. Is that okay with you?
MR. CARVIN: Yeah, but we've got a lot of --
MR. YEAGER: We'll make it quick. We'll step out very quickly.
(At 11:23 a.m. went off the record.)
(At 11:28 a.m. went on the record.)
MR. YEAGER: Can you read back the question please?
(Record read: Q. Was there any health issues which prevented you from rapidly responding to discovery requests or providing the kind of code that we've been discussing between, say, June 1st and mid August?)
THE WITNESS: The answer is yes.
BY MR. CARVIN:
Q. And can you give me a rough time estimate, how long were you disabled or disadvantaged?
MR. YEAGER: Well that's going to ask him to reveal another bit of health information.
MR. CARVIN: I don't need it.
MR. YEAGER: You don't need it? Okay.
MR. CARVIN: I got to get through this.
MR. YEAGER: Okay.

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BY MR. CARVIN:
Q. My last -- what compiler do you use?
A. What Java compiler do I use?
Q. Yes.
A. I use a number of different -- I have used a number of different compilers. I most commonly use, it's just a piece of software called Eclipse, E-C-L-I-P-S-E.
There are others that I've used from time to time. I can't recall names off the top of my head, but there are others.
Q. Which one did you use here?
A. Which compiler did I use for the purpose of the -- for the simulations here in my report?
Q. Yes.
A. Again, I used a number, and Eclipse is certainly one that I used. I recall that I have certainly used another one that -- I'm trying to think of the name, but I just can't get it off the top of my head.
But I have tried using multiple compilers, and Eclipse is the one I most commonly use.
Q. Do you recall which one you used here?
A. Multiple.
Q. So it wasn't just Eclipse?
A. I don't want to say that it was definitely only just Eclipse. I definitely recall at times using other compilers, with

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Eclipse being the most common one.

I recall having definitely used another compiler called -- I believe it's called Netbeans.

Q. Can you spell that, please?

A. I think it's N-E-T-B-E-A-N-S. That's all I can recall off the top of my head right now.

Q. All right. If you could turn to page three of your report, please.

A. (Witness complied.)

Q. And you provide a summary of the statutory criteria, that you say the statutes described five criteria to be followed in producing each districting plan, correct?

A. I see that, yes, sir.

Q. And then you list the five criteria, correct?

A. Yes, sir.

Q. Okay. Then you state, both statutes state that the list of districting guidelines detailed in each statute is exhaustive.

Is that right?

A. I see that.

Q. Then you say, hence it is clear that both statutes not only specify the five districting criteria in their order of priority, but they also prohibit any other considerations.

Is that correct?

A. I see that.

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Q. Okay. So it's your understanding of the statute that they not only specify the five districting criteria, but they prohibit consideration of other considerations, correct?

A. Yes. And I'm just going to qualify that obviously, as I relatedly explained earlier today, when I use the word prohibit there I'm talking about prohibit for the purposes of my applying the criteria to my own simulations. I'm obviously not giving you a legal opinion.

Q. Nor are you commenting on what other map drawers might have understood were the criteria guiding the redistricting in Michigan, is that correct?

A. To my knowledge, I don't know of -- well, I just don't know of what other map drawers may have been, or not been using. So that's -- I think that's a correct statement because I just have no personal knowledge of other map drawers.

Q. So when you use the words, the statute prohibits any other considerations, you were not suggesting that the statute prohibits line drawers in Michigan from considerations in addition to the five listed statutory criteria, is that correct? You're just saying what you did.

A. I'm talking about how I applied the criteria. I'm obviously not talking about a legal opinion regarding what other map drawers should or should not do.

Q. Right. You're not offering either a legal or layman's opinion about what the statutory criteria require

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redistricters to do in Michigan, correct?

A. I'm not sure how a layman's opinion would be different than a legal opinion. But the point is I'm not offering any legal expertise about how this statute would apply to other map drawers, aside from explaining how I imposed these prohibitions and these criteria on my own computer code.

Q. So in your understanding of the statutory criteria, did the statutes prohibit consideration of incumbency protection, preserving the cores of existing districts, preserving communities of interest?

A. Again, same qualification as before, not a legal opinion.

And my reading of the statute tells me that there are criteria to be used, and that I interpreted those criteria, and the statute, as telling my simulation algorithm to not use any other criteria not mentioned, such as incumbency protection.

MR. YEAGER: I apologize, just let me turn this off.

Go ahead.

BY MR. CARVIN:

Q. You described what you used to come up with your simulations. My question is somewhat broader.

Do you have an understanding of the statutes that would prohibit as impermissible in Michigan consideration of non-listed criteria such as protecting incumbents, preserving the cores of existing districts, and preserving communities

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of interest?

A. As impermissible in Michigan, is what your question asked? And I interpret that as asking whether I have a legal opinion, and I don't.

Q. What I'm asking you -- I don't want you to qualify it as a legal opinion.

When you're interpreting the statute, do you have any interpretation of the statute which would prohibit consideration of incumbency protection, cores or communities of interest?

MR. YEAGER: Asked and answered.

You may answer.

THE WITNESS: Like I said, it's just not part of my expert opinion to say what the statute means for Michigan drawing maps.

BY MR. CARVIN:

Q. Okay.

A. I can only tell you what it meant for the purpose of my operationalizing these in simulated plans.

Q. Are you aware that incumbency protection, preserving the cores of existing districts, often play a role in redistricting generically?

A. I'm generally aware that those have been cited and sometimes -- cited or alleged as considerations in other states. I'm very generally aware of that. I'm not saying

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anything about the legality of it. Obviously I'm not saying anything about whether that is permissible.

But I'm generally aware those are cited or alleged.

Q. And how about is preserving communities of interest a traditional districting --

A. Actually, I want to just make sure that I heard your previous question correctly. And I apologize for going back, but could I hear the previous question again and make sure that I answered the question that I thought I was answering?

(Record read: Q. Are you aware that incumbency protection, preserving the cores of existing districts, often play a role in redistricting generically?

A. I'm generally aware that those have been cited and sometimes -- cited or alleged as considerations in other states. I'm very generally aware of that. I'm not saying anything about the legality of it. Obviously I'm not saying anything about whether that is permissible.

But I'm generally aware those are cited or alleged.

Q. And how about is preserving communities of interest a traditional districting --)

THE WITNESS: Thank you.

I just want to go back to the previous question.

And I want to qualify that the answer I gave to the previous

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questions only applies to the protection of incumbents, which -- that was what I was giving my answer to.

With respect to, I think you described it as preservation of the cores, I'm not sure that I'm able to give the same answer to that one.

BY MR. CARVIN:

Q. Let's break it up.

Is preserving the cores of existing districts in your opinion as a political scientist a traditional districting principle?

A. No, sir.

Q. Why not?

A. Usually what we mean by traditional districting criteria, as a political scientist, is criteria that are commonly enshrined in various state's constitutional or statutory provisions laying out principles to be followed or criteria to be followed in districting.

Q. It's -- I'm sorry.

A. I was just going to add to that by saying that, so it is not the case that, for example -- it is not the case that most states have constitutional or statutory provisions requiring the, some kind of idea of preservation of cores.

So that's why we wouldn't call it a traditional districting principle as a political scientist.

Q. So it's your understanding in the political science community

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they use the word traditional districting principles to only reference criteria that are specifically specified in the constitution or state statute, is that your testimony?

A. That's not quite what I said.

What I said was traditional districting criteria is usually what I would refer to as a political scientist as a principle that is commonly or often enshrined in state constitutions or in state statutory guidelines regarding criteria to be followed in redistricting.

An example is compactness. That's one that you very commonly find as being one that's required or a guideline for redistricting in many different states, possibly most states.

So that's all. I just wanted to clarify that. I don't think what you recounted was quite what I said.

Q. I'll ask it again. Is it your understanding that traditional districting principles only encompass criteria that are specifically referenced in constitutional or statutes in the particular state?

MR. YEAGER: Asked and answered.

You may answer.

THE WITNESS: Right, and my answer again is, no, that was not my understanding.

BY MR. CARVIN:

Q. Okay. So it could include things that are not referenced in

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constitutions and statutes, correct?

A. That's not -- that's also not what I said. But I'll take that question by itself.

And I think your question was, could traditional districting criteria include things that are not referenced at all in state statutes or in constitutions.

Certainly it's possible that if there is one state that does not reference compactness, that certainly doesn't mean that compactness is not a traditional districting criteria.

But if, say, in a hypothetical world there were no state constitution, no state statute, no legislative statements regarding redistricting criteria that ever mentioned compactness, then it would be awfully hard to claim that compactness is a traditional redistricting criteria. That's obviously a counterfactual hypothetical.

But that's the basis of my answer.

Q. But we agree that traditional districting principles can include factors that are not mentioned in the constitution or statutes, correct?

A. I think that's the question you asked a moment ago, so I'm just going to give the same answer.

It certainly is possible that if there is a criteria that is not mentioned in one state's constitution, that fact by itself does not automatically mean that the

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criterion is not a traditional districting criterion.

Q. That's not my question.

The question, for the fourth time is, do traditional districting principles include criteria that are not mentioned in the state's constitution or the state's statute?

MR. YEAGER: Objection, asked and answered.

You may answer.

THE WITNESS: Okay. I'm going to answer the question that I think I heard, which is the same question that I think I've heard previously.

Which is that it certainly is the case that if there is one state's constitution that does not include a specific criterion like compactness, that doesn't automatically mean that compactness is not a traditional districting criteria.

BY MR. CARVIN:

Q. Could it include -- I'll try it again. So it could include criteria that are mentioned in other state's constitutions and statutes, correct?

A. Traditional districting criteria could include criteria that are included in other state's constitutions and statutory criteria.

You said could, and I agree with that, that is possible.

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Q. Okay.

A. Obviously I'm not saying it's automatically the case, but it is possible.

Q. Do you have a view as to whether or not preserving the cores of existing districts has ever been mentioned in judicial opinions as a traditional districting principle?

A. I'm not specifically aware of that right now.

Q. If they have been referenced as traditional districting principles in judicial opinions, how would that affect your attitude about whether or not it's a traditional districting principle?

A. I'm not sure that it would.

Q. Meaning the fact that the judicial opinions reference it as a traditional districting principle would not suggest to you that preserving the cores of existing districts is a traditional districting principle?

MR. YEAGER: Objection, incomplete hypothetical.

You may answer.

THE WITNESS: Yeah, I'm not sure that would affect my opinion.

BY MR. CARVIN:

Q. What do you mean you're not sure?

A. I can't say for certain.

Q. One way or the another?

A. Correct.

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Q. So it might be a traditional districting principle if it's been mentioned in a traditional opinion in your understanding?

A. As I said earlier, what I mean by the term traditional districting principle is whether it is enshrined in state constitutions and state statutes.

Q. Okay.

A. You're posing evidence that is outside of that.

Q. Is it widely accepted in the political science community that traditional districting principles only include criteria that are -- or usually only include criteria that are mentioned in constitutions and statutes?

A. Oh, I'm telling you how I use the term. I mean I can only speak about how I understand the term as a political scientist.

Q. Right.

A. I'm not going to testify for you that, say, all political scientists share the same view or that an X percentage of political scientists share the same view. I'm just here to testify about my own expert opinions.

Q. Right. So you're not offering any view as to what the political science community would view as traditional districting principles, just your own personal views, correct?

A. Like I said, I've not taken a survey or a poll of other

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political scientists, so I really can't give you any basis for saying X percent or 75 percent of political scientists share exactly my view or disagree with me.

Q. Okay. How about communities of interest, is that a traditional districting principle?

A. My understanding is that different jurisdictions have different -- when employing that phrase, have used different meanings of communities of interest.

So there is not -- that means that we don't have the ability to issue a blanket statement by saying communities of interest definitely are or definitely are not a traditional districting criteria simply because different jurisdictions often mean different things by that.

So I'm not able to give you a straight, absolute yes or no answer.

Q. Okay. Can you turn to page 59 of your report, please?

A. Yes, sir.

Q. If you'd turn to the third full paragraph, please.

A. Yes.

Q. Just to put this in context, I'm reading from Appendix A where you describe the statutory guidelines and the computer-simulated districting algorithm that you did in this case, is that right?

A. Third full paragraph, I see that.

Q. Okay. Because, and you state there do you not, because of

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the clarity, specificity and exhaustiveness of the referenced statutes regarding the five districting criteria, as well as their order of priority, programming the districting simulation algorithm to produce Congressional, Senate and House plans for Michigan was a purely technical exercise with no subjective judgement or guesswork needed.

Is that correct?

A. I see that.

Q. Okay. And that's what you did?

A. Yes, sir.

Q. It was a purely technical exercise, right?

A. Yes, sir.

Q. And so all one thousand simulations were the same goals with respect to contiguity, equal population, minimizing county and municipal breaks and compactness?

A. Oh, I employed those five criteria, yes, sir.

Q. Right. And in this technical way, the algorithm was instructing how these simulations were to come about. Right?

A. Well I don't know that they were instructing how the plans were to be drawn, they were instructing a specific process by which the plans were to be drawn.

Q. Okay. And the process was, for example, after contiguity and equal population, that they should seek to minimize the number of county and municipal breaks, right?

A. Correct.

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Q. And if you could turn to page 15 of your report.

A. Yes, sir.

Q. Okay. So this is detailing the comparison of the enacted Congressional plans and your computer-simulated Congressional plans, is that right?

A. Yes, sir. And I'm just going to point out here, now that you've referenced this table, I believe that there was a corrected version --

Q. Okay.

A. -- of this table. And I'll bring it up again if you ask me about the parts of it that I recall were corrected.

Q. Okay.

A. I just wanted to raise that.

Q. So well it's more of an illustrative point. You have, for example, that in 22 simulated maps there was nine county breaks, and in 978 simulated maps, there was ten county breaks.

That was not part of your errata, was it?

A. You're correct, sir.

Q. All right. Can you explain to me why that would come about if the criteria encouraged and required minimizing county breaks, why the vast majority of them would have an additional county break that was unnecessary?

A. I'm not sure what you mean by was unnecessary. If you could just clarify.

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Q. We know that it is possible to create a congressional plan with only nine county breaks, right, because 22 simulated maps came up with that?

A. Okay.

Q. Right? And I'm just wondering why, if it's possible to do that, why the algorithm wouldn't have had all one thousand of the simulated maps do that?

A. Okay. So you're just generally asking why it is that the computer also produced these 978 congressional plans that did not reduce the number of county breaks to nine.

Is that right?

Q. Yes.

A. Okay. Let me just start by pointing out that when -- I think you're reading the 978 from the second row, if I got that right.

Q. Yes.

A. Okay. And that second row is describing the number of counties divided into multiple districts.

Q. Okay.

A. So what the second row is telling us is that the enacted plan divided eleven counties into multiple districts in the enacted plan.

Q. Right.

A. And the number of divided counties in the simulated plans was either nine or ten.

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But your question, I think from a moment ago, unless I misheard you, was about county breaks.

Q. Let's eliminate the ambiguity. Let's go down to the next one, okay?

Municipal breaks, now we're talking about municipal breaks, right? And 18 simulated maps found nine municipal breaks, and 982 had ten municipal breaks.

And I'm wondering why under the algorithm the vast majority would come up with a municipal break that apparently was not -- was avoidable?

A. Okay. I will answer that question. But if you could, please, I just want to go back and finish my answer to your previous question.

Q. There is no reason to, we can move on.

MR. YEAGER: Are you withdrawing the prior question?

MR. CARVIN: Yes.

MR. YEAGER: Let's go on then, he's withdrawing the prior question.

THE WITNESS: Okay. So I think I understand your question. You're basically asking why it is that there are 982 simulated maps that split -- or, sorry, that have ten municipal breaks, when certainly you're saying correctly, that it's possible, in the simulations, to produce only nine municipal breaks.

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And the answer is that every simulation is a little bit different. The simulation is within the constraints that are, that I've described, is a random districting process, certainly within constraints, and within goals that are being pursued here.

So the algorithm is trying to draw different districts with an eye towards minimizing county breaks, and minimizing municipal breaks, but it's not going to arrive at the exact same plan every single time. Otherwise we would just end up with one thousand completely identical plans.

So there is randomness in the process. Which is why the plans are going to be a little bit different from one another, and that's why, when -- even when you pursue a specific goal like minimizing county breaks or minimizing municipal breaks, you're not always going to arrive at the exact same plan every single time because of the randomness inherent in the computer simulation process.

And another way of putting it is that what the computer is doing is not dictating a certain set of lines to be drawn. It's not dictating the districts be drawn with particular boundaries, so much as it's saying draw random districts, but when you're drawing these random districts pursue certain criteria.

So that's why there is some small amount of variation here in the number of municipal breaks that we see

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in the simulated plans.

BY MR. CARVIN:

Q. Well if you could turn to page 40 of your report.

A. Okay.

Q. I'll point you to the number of municipal breaks, this is related to the House plans. 300 simulated maps came up with 13 municipal breaks, and 700 came up with 14.

Is your answer essentially the same on why the difference between the two?

A. Yeah, I would give the same explanation.

Q. Okay. Is 14 a de minimis difference from 13, in your view?

A. I'm not sure what you mean by de minimis.

Q. Is it significant to you as a political scientist analyzing these plans?

A. I'm not sure that a political scientist -- I'll just speak for myself. I don't really have an opinion on whether something is a de minimis difference.

All I do is quantify. I can say it's a difference of one. I really don't have an expert opinion as to whether one is huge or one is tiny or de minimis.

Q. If a line drawer considered factors other than the five statutory criteria, such as protecting incumbents, preserving the cores of existing districts, and preserving communities of interest, that might explain the departure from the statutory criteria, correct, relative to the simulated plan?

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A. Well I'm going to try my best to answer your question, and I'll just qualify it by saying that's a hypothetical. I haven't analyzed it, but I'm going to do my best shot of giving a guess.

Certainly I can hypothetically think of, say, if you really wanted to place certain incumbents in certain districts or not pair certain incumbents, you could do that by manipulating district lines and, say, breaking an extra municipality or breaking a county -- breaking an extra county.

I mean as a purely hypothetical matter, yes, one could pursue a certain placement of incumbents in a certain configuration and achieve that by breaking more counties or breaking more municipalities. Just as a purely hypothetical matter, that's possible.

But obviously I'm not giving you an opinion as to whether in general this explains that, whether or not a particular criterion that I did not put in my simulated plans would necessarily cause or justify or lead to a certain change in number of municipalities being broken, etcetera. I just wanted to qualify my answer that way.

Q. Right. What about preserving the cores of existing districts? That too could have an effect on the number of county lines broken or the compactness of districts. So that might well be an explanation from more county line breaks and

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lesser compactness than the simulated plans because they didn't consider that as a criteria, right?

A. Well that is a little bit of a different situation and the answer there is it depends. So I'm just going to clarify something first and then I'll give you my best shot at answering your question.

So I think when you're talking about preservation of cores, my understanding, and please correct me if I'm wrong, is that you're talking about preserving the cores of the districts from the previous decade's plan. So with that understanding let me try and answer your question.

So it really depends. If we had a previous decade's plan -- or I'll just call it a benchmark plan. If we had a benchmark plan that did a really poor job of following municipal boundaries, and a really poor job of following county boundaries, let's just hypothetically say they split apart one thousand different municipalities and 50 counties, obviously a very extreme hypothetical. And if that were the existing benchmark plan, and a map drawer came in and said, I would like to preserve the cores of those benchmark plan districts as much as possible, the best way to do that is to draw a plan that similarly breaks apart all of those one thousand municipalities or 50 counties or whatever I said.

That is an example, kind of an extreme example, of

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where preservation of cores taken to an extreme would lead to a plan that really breaks a part of lot of municipalities or counties.

Q. What if --

A. At the very -- if I could just try a finish my explanation here.

At the other sort of extreme, if you had a benchmark plan that does a really good job of not breaking apart counties, not breaking apart municipalities, and you had a map drawer come in and say, I'm going to try and draw a new plan that preserves those cores as much as possible, then it may well be the opposite, that trying to preserve the cores of a benchmark plan that actually minimized county breaks leads to another plan that also minimizes the number of county breaks.

So that's why I said it really depends.

Q. And what, for example, in this case, if the 2011 plan largely mimicked the number of county breaks in the benchmark plan, that would suggest that they were trying to achieve the same minimization of county breaks, while preserving the cores of existing districts, right?

MR. YEAGER: Objection, incomplete hypothetical.

You may answer.

THE WITNESS: That would not necessarily lead to the conclusion that you're posing.

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BY MR. CARVIN:

Q. Well have you examined whether or not the 2000 redistricting did a good job, as you said it in terms of preserving county lines?

A. I did not analyze that.

Q. Okay. Have you analyzed whether or not the existing plan does as good a job as the prior plan in terms of preserving county lines?

A. Because I did not analyze the previous decade's plan for the purpose of my expert report, I can't make that comparison for you here.

Q. So the hypothetical you gave me a minute ago, where the benchmark plan tried to do a good job in terms of minimizing county breaks, and the next plan sought to preserve the cores, one very natural explanation would be that they would come out with the same amount of county breaks as the benchmark plan, is that right?

A. No, that would not necessarily be the case. I'd need to have more information.

Q. But before you said, if they had tried to do a good job in the benchmark plan, and the new plan preserved those cores, then one would expect they would do as good a job?

A. Well I said that it may well be.

Q. Yes.

A. It may well be the case.

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Q. And you haven't examined that hypothetical in Michigan, have you?

A. I haven't examined the benchmark or the previous decade's plan.

But what I said was that it may well be that preserving --

Q. Right.

A. -- the cores would mean drawing a plan that actually breaks a similarly few number of municipalities and counties.

It may well also not be. There are a lot of other factors such as population changes, redrawing of the municipal boundaries, and probably many other factors that I could think of, but just haven't named yet, that would also affect the source of things.

But the point is it could be, and it may not be.

Q. And you haven't sought to answer that --

A. I have not.

Q. Okay. And you haven't explored the possibility of the fact that preserving the cores of existing districts because that was not among the five enumerated statutory criteria that were programmed in your simulation?

A. Well it just wasn't one of the criteria that I followed.

Q. So you don't know what the effect of somebody who sought to preserve the cores of existing districts would have on the plan here?

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A. That's not a question that I have analyzed for my report.

Q. If there was a departure from the simulated plans that was explained by preserving the cores of existing districts, it would be false to assume that the departure from the simulated plans was caused by partisanship, correct?

MR. YEAGER: Objection, incomplete hypothetical, misstates the record, hypothetical.

THE WITNESS: If I could ask you to read back the question.

(Record read: Q. If there was a departure from the simulated plans that was explained by preserving the cores of existing districts, it would be false to assume that the departure from the simulated plans was caused by partisanship, correct?)

THE WITNESS: Okay. I think I understand the hypothetical you're asking.

And my answer is that it is correct that I just wouldn't automatically assume that conclusion. I would have to do further analysis.

But your question was just whether I would assume that conclusion, and my answer is I would not assume that conclusion.

BY MR. CARVIN:

Q. Okay.

A. I would do further analysis if I were to try and answer that

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question.

Q. What does your algorithm do with respect to the requirements of the Voting Rights Act?

A. I did not explicitly program the algorithm to try and interpret and account for the Voting Rights Act in any particular way.

As you -- as my report explains, I dealt with a number of majority-minority districts in surrounding areas in a particular way. And obviously I'm happy to go through that if that's responsive to your question.

Q. Basically you just froze all the majority-minority districts in the state and the Senate, House and Congressional plans?

A. That's a part of what I did.

Q. What else did you do?

A. Okay. I'll start -- I'm going to have to start with each plan individually. So I'll go through in detail and maybe you can stop me if this isn't responsive to your question.

So I guess I'll start with the Congressional plan. And certainly for the Congressional plan --

Q. Maybe this will be simpler, did you do anything other than freezing the majority-minority districts to account for the requirements of the Voting Rights Act?

MR. YEAGER: Just to clarify, are you withdrawing the prior question?

MR. CARVIN: I'm just trying to cut to the chase.

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MR. YEAGER: Well, if you're not withdrawing the prior question, you need to let him finish.

MR. CARVIN: Yes, that's my question.

MR. YEAGER: Wait, I'm sorry. I want to be precise. Did you withdraw the prior question?

MR. CARVIN: Sure.

MR. YEAGER: Thank you.

Now you can answer the question that's on the table.

THE WITNESS: Okay. I don't have any particular understanding of what I did to be, say, an interpretation or following the Voting Rights Act or not following the Voting Rights Act.

I'm happy to tell you what I did with particular frozen districts, and in one case with a Flint area district.

So I'm happy to talk about those, but I want to clarify at the outset that I don't have a particular understanding of what I'm doing as necessarily following or not following the Voting Rights Act.

So with that, I'm happy to go into specifically what I did.

BY MR. CARVIN:

Q. All I'm trying to clarify at this point, Professor, is if you want to tell me how you froze the districts, I'm more than happy to have you elaborate on that. But I just want to clarify at the outset whether or not you did anything other than freeze the districts to comply with the Voting Rights Act, or was that really what you did was freeze the majority-minority districts?

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A. I understand your question. And I'm going to try to answer it here. What I'm also trying to be careful to do is not to characterize my answer as being responsive to the part of interpreting the Voting Rights Act. But I'm trying to give you a complete answer here.

Q. Explain to me, did you freeze all the majority-minority districts?

A. To my knowledge, the districts that I froze includes all of the majority-minority districts in the Congressional, the Senate and the House plans with one exception.

Q. What's that?

A. And there is a different -- so the area is Flint in the House plan. And I'm going to explain to you what I did.

I'm going to qualify again at the outset that I don't take this to either mean following or not following the Voting Rights Act, but I'm going to explain to you what the simulation algorithm does in Flint.

In the area of Flint the algorithm, it makes sure that there is -- the simulations make sure that there is a district in the Flint area that has a black voting age population, an African American voting age population of 55 percent or higher.

I did not freeze any Flint area districts for the purposes of the House plan.

So I'm just saying that to explain what I did. And again, I'm being careful not to characterize that as either following or not following the VRA.

Q. Why didn't you freeze the Flint district?

A. Why didn't I freeze the Flint House district?

I took the approach that I just described because Plaintiffs' counsel instructed me to do so.

Q. What was the approach?

A. Okay. What I was just --

MR. YEAGER: Asked and answered.

You may answer.

THE WITNESS: The approach was that the computer requires that there be a district, a House district, a simulated House district in the Flint area that has an African American voting age population of at least 55 percent.

BY MR. CARVIN:

Q. And could that be different than the 55 percent district in the enacted plan?

A. Could the number -- could the BVAP be different?

Q. No. Could the district be different even though it achieves the same BVAP?

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A. Okay. The district doesn't necessarily achieve the same BVAP, the district there just necessarily achieves a 55 percent.

And the answer is, yes, the district could well be different.

Q. Okay. As I understood it with respect to, for example, the two minority-majority districts in the Congressional plan you froze the lines. You didn't come up and say, create a district with an equivalent BVAP or certain minimum BVAP for the Congressional districts. Do I have that right?

A. The Congressional simulations just freeze the lines for Congressional districts --

Q. Right.

A. -- 13 and 14.

Q. And that's -- you took a different approach with respect to the majority black district in Flint, you did not freeze the lines?

A. With the House plans --

Q. Right.

A. -- in Flint? That is correct.

Q. Okay. But you did have some district in the Flint area with a minimum of 55 percent BVAP?

A. There is going to be one district in Flint.

Q. Okay.

A. I don't think it's -- I'm not sure that I ever specifically

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analyzed this completely, but I don't think it's really possible to draw two or more.

Q. Okay.

A. There is going to be one district in the Flint area, one House district in the Flint area with a 55 percent BVAP.

Q. Was that the only majority black district in all of the plans where you didn't actually freeze the lines, the one with the House district in Flint?

A. To my knowledge, to my recollection, that is. And my recollection is I analyzed the racial compositions of all the enacted districts in the various plans, and that was the only area in which I did not freeze a majority-minority BVAP district.

Q. And the algorithm did not put in anything about any criteria relating to the Voting Rights Act?

A. The algorithm does not really -- it's a computer. It's not really capable of making sense of or understanding the Voting Rights Act other than me putting in instructions such as freeze this district, achieve a 55 -- you know, the computer code can certainly calculate the BVAP of a district and apply that, but obviously the algorithm has no idea what the Voting Rights Act means other than me programming it that way.

Q. And you didn't program it with respect, outside of the House Flint district, you didn't program it with respect to BVAP in any other district?

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A. I didn't -- there is no analogous place where I said, say, the districts have to have a BVAP of a certain population except obviously when you're freezing certain districts in, say for example in Wayne County, obviously you're going to achieve whatever BVAP was already there in the enacted district.

Q. So your algorithm takes no account of Section 5 of the Voting Rights Act?

A. That is beyond my expertise to tell you that the plans produced by an algorithm either do or do not comply with Section 5.

Now I mean obviously the algorithm, it's a computer, it's not able to interpret or understand Section 5 beyond the instructions I put in there, which we've been talking about here.

Q. And you gave it no instructions with regard to Section 5 of the Voting Rights Act?

A. I'm just not able to answer that question beyond saying the instructions that we've been talking about are the instructions that I put into the -- or put into the computer code.

The algorithm doesn't -- the computer code can't tell you, and I cannot tell you whether a particular plan complies with or doesn't comply with Section 5.

Q. Do you know what Section 5 of the Voting Rights Act requires?

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A. I'm generally aware of it, but I can't really give you any legal interpretation --

Q. Give me your best --

A. -- or a precise legal definition.

Q. Give me your best understanding.

MR. YEAGER: Objection, calls for speculation based on the prior answer, lack of foundation.

You may answer.

THE WITNESS: Okay. I'll give you my best shot. I'm going to start again by qualifying that I have no legal expertise on this, on the question that you're asking me. This is not part of my academic expertise to tell you what is required for a particular districting plan.

And so with that qualification I'll give you my best shot.

My understanding is that -- and I'm going to further qualify by -- well I'll just give you my best shot here.

My understanding is that Section 4 and Section 5 generally require pre-clearance for certain jurisdictions, when there are changes in things like district boundaries. And that the pre-clearance process requires submission to the Department of Justice. And that there are various rules that have been applied during that -- during that pre-clearance process. Sometimes that pre-clearance process leads to Court

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cases.
So that's generally what I'm aware of.
BY MR. CARVIN:
Q. Do you know what the substantive standard of Section 5 is?
MR. YEAGER: Same objection.
You may answer.
THE WITNESS: I'll give all the same qualifications again that I'm not qualified -- I'm not legally qualified to answer the question.
I have a very general understanding that there is a retrogression standard. I can't really tell you exactly how it's applied to any particular case.
(At 12:13 p.m. went off the record.)
(At 1:01 p.m. went on the record.)
MR. CARVIN: Okay. We can go back on the record.
(At 1:01 p.m. Exhibit 2 marked.)
BY MR. CARVIN:
Q. Good afternoon, Professor Chen.
I'd like to begin by directing your attention to what's been marked as Chen Exhibit 2, and those are the statutory criteria that you referenced, I'll represent to you in your report, MCL 4.261 and MCL 3.63, okay? And I'd like to ask you a few questions about that.
MR. YEAGER: Do you have extra copies of that?
MR. CARVIN: I apologize, sure.

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MR. YEAGER: Thank you.
BY MR. CARVIN:
Q. If you could turn to page 59 of your report, please.
I'd like to direct your attention to the fourth sentence in the first paragraph. You state, both statutes are clear that district contiguity is an absolute inviolable principle and that county and municipal lines may be broken only for the purpose of satisfying the district population threshold requirement.
That's your understanding of the statutory criteria?
A. I'm just trying to get to where you are. We're on page 59, and which paragraph?
Q. First paragraph, fourth sentence, begins, both statutes?
A. Both statutes.
Okay. I see that.
Q. Okay. And that's your understanding that county and municipal lines may only be broken for the purpose of satisfying the district population threshold requirements, is that correct?
A. And contiguity.
Q. Yes.
A. Yes.
Q. Okay. And you cite on page 63 the Congressional statute for that where it says, Congressional district lines shall break

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as few county boundaries as is reasonably possible.
And later down, Congressional district lines shall break as few city and township boundaries as is reasonably possible. Okay.
My question, however, goes to the state legislative lines. Where does the Act 463 governing state legislative lines say that it shall break as few county, city and township lines as possible?
A. Okay, if you'll give me a moment to review.
Q. Yes.
A. Okay. We're on 4.261, section (e), and my recollection of what I did is that I read section (e), that states Senate and House of Representative district lines shall preserve county lines with the least cost to the principles of equality of population.
Q. Right. So that's different language than the Congressional statute which says as few as reasonably possible, but you think it means the same thing?
A. Let me just compare those two.
I don't know that it was necessarily my interpretation that they mean the same thing. I certainly read this part of the 4.261 statute, and obviously I spoke about it with Plaintiffs' counsel and came away with that understanding.
Q. Okay.

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A. It wasn't something that I analyzed whether or not it was exactly the same or written the same as the Congressional statute. I just developed a, my own understanding of 4.261 by reading it and consulting with Plaintiffs' counsel.
Q. All right. What is your understanding of what it means when it says, shall preserve county lines with the least cost to the principle of the equality of population? What does that mean?
A. My understanding of that section, and of what the statute is calling for, at least as applied to my simulations, was that district lines were going to be drawn in a way so that you were not supposed to -- one was not supposed to, say, violate the general 95 to 105 percent population requirement laid out in (d) in order to break fewer counties or fewer municipalities.
So I interpreted least cost of the principle of equality meaning that you could not subordinate the population equality threshold requirement in favor of decreasing the number of county lines broken.
Q. Okay. So if option one was to, say, have 95 percent population equality, without breaking the county line, but option two was to have 99 percent population equality that does break the county line, then option two would be permissible or required under this section under your understanding?

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A. I'm not -- I think I heard the question correctly, and so -- I don't think that's quite right.

What I interpreted, the way I applied this, was to say that the population equality threshold was not somehow compromised by having a 95 rather than a 99 percent populated district.

And that certainly if you're choosing between those two sorts of districts, then you want to consider minimizing county breaks.

Q. So you think least cost to the population principle of equality only means don't go below the 95 percent or 105 percent threshold?

A. My understanding is that the principle of equality of population refers to those 95 to 105 percent threshold. So there would be obviously a cost to that principle, were a district to deviate outside of the 95 to 105 percent boundaries.

Q. So what do you think least cost means then? In neither instance can you go beyond the 95 to 105 percent requirements, so how do you interpret the word least cost?

A. I'm not sure that I made any particular attempt to attribute any meaning to that other than the way that I just described, which is that I applied this principle by saying, it's got to be 95 to 105 percent of the ideal district population. And then within those boundaries, a district line is to be drawn

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so as to try to not break, not break counties.

Q. This will be my last question on this. It's quite clear that the 95 to 105 percent threshold predominates over county lines regardless, right, because of the priorities you said?

A. Well I gather that from (e), among other parts of the statute here.

Q. Okay. All right. Let's turn to (f), right after that, okay?

A. Okay.

Q. Do you see (f) right underneath (e) that we were talking about?

A. Yes.

Q. It says, does it not, if it is necessary to break county lines to stay within the range of allowable population divergence provided for in subdivision (d), the fewer whole cities or whole townships necessary shall be shifted between two cities or townships, both of which will bring the districts into compliance with subdivision (d) and (h), the city or township with the lesser population shall be diluted, do you see that?

A. Yes, I see that.

Q. If you could turn to page 62 and 63 of your report.

A. (Witness complied).

Q. This describes what the algorithm does with county and municipal breaks. But it contains no discussion of the provision, or the concept I just talked about that in the

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event of a county or municipal line break, the fewest whole cities or whole townships necessary shall be shifted.

Was that something you put in your algorithm?

A. What the algorithm does is when it's going through, say, iterative changes and redrawing the boundaries between districts --

Q. Right.

A. -- it will build up a district, first in order to fill up a county. And then, say, it has to intrude into a neighboring county in order to complete the district, it will start randomly adding municipalities --

Q. Right.

A. -- cities and townships, and add just enough to achieve an equally populated district. So that's what the algorithm does.

Q. Right. But it doesn't -- there is nothing in the algorithm that says shift as few as possible, right? If you had one district -- well, is there any provision that says shift as few as possible?

A. You're asking me to read (f), is that right?

Q. Yes.

A. I see that on the second line there is the phrase, the fewest whole cities or whole townships necessary.

Q. Right. And is there a provision in the algorithm that requires the shifting of the fewest whole cities or townships

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when a county line is broken?

A. Well what I'm explaining is what the algorithm does is like I said when it intrudes into a new county, it adds -- it keeps on adding municipalities chosen at random and adds enough to bring it to an equally populated district.

Q. So just so we're clear, you didn't have any specific directions in the algorithm to shift the fewest; you're just saying that that's what you think the result --

A. It's not going to, say, create an equally populated district and then keep on adding municipalities is what I'm clarifying.

Q. Right. Okay. But there is no specific directive in the algorithm to shift the fewest counties, is that correct?

A. Well I'm just clarifying what the algorithm does.

Q. Right.

A. It adds enough just to get to an equally populated district, and then stops.

Q. Right. And you're saying --

A. So I think you're asking, are there are any extra steps beyond that, the answer is no.

Q. Okay. Now let's assume that, for example, if you could go to the last sentence of (f), between two cities or townships, both of which will bring the districts into compliance with subdivision (d) and (h), the city or township with the lesser population shall be shifted.

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Was the algorithm directed, when it had a choice, to bring it into the population threshold to choose the city or township with the lesser population?

A. It was not intentionally, say, advantaging the city or the township with the lesser population.

Q. Okay. All right. Do you know if you -- so you didn't get into that at all.

Do you know how many cities or townships were shifted, for example, in the House plans?

A. You're asking how many cities or townships were shifted in counties that are broken, is that right?

Q. Well obviously, yes, that would be the context in which it would arise.

A. Okay. And the answer is that I did not systematically go and analyze that with the enacted or simulated maps.

Q. Okay. With respect to the Senate and the House plans, do you know how close to perfect population equality the simulated plans were?

A. Let me take that one at a time.

With respect to the Senate and the House maps, perfect -- how close to perfect population, the simulated or the enacted?

Q. Simulated.

A. The simulated maps.

Well, I followed the criteria, the statutory

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criteria regarding population equality, as I laid out in my report, as I explained. And so in general, for most districts, that threshold is 95 to 105 percent.

Q. Right.

A. There are a few -- there are some exceptions to that. But in general it's 95 to 105 percent.

So that would be -- the ideal House district in Michigan is something like 89 thousand several hundred people. And so 95 percent of that is something in the rough ballpark of, I believe, 85 thousand, and maybe several hundred people, up to, I believe 94 thousand several hundred people. I don't have the exact numbers off the top of my head. I think some of those numbers are reported in my report.

But I think you got the idea.

Q. Right.

A. So in general 95 to 150 percent. And then there is -- there are specific places where the population equality has got to be more -- has got to be a bit higher than that from 98 to 102 percent and for the House plan that applies to Grand Rapids --

Q. Let's put that to the side.

A. Okay. We won't go into that right now. We'll talk about that later.

Q. But the 98 to 1 --

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A. My point is just that in general it's obviously 95 to 105 percent. And then of course I understand in Detroit it's also got -- you also got that special 98 to 102 percent.

Q. I'm just talking about the general rule.

The algorithm would accept plans to use your recollected numbers, either 85,000 or 94,000 in a House plan, because that would be within the plus or minus 5 percent, right?

A. We'll just call it 95 percent to 105 percent.

Q. Right. And they would accept that?

A. Yes. That's -- I mean that's the population threshold that the algorithm is using.

Q. And what's the average deviation into the simulated plans from the perfect 89,000 equality?

A. I'm not sure that -- the average deviation district by district?

Q. Well if you sum them altogether, what would be the average deviation?

A. Well I'm just going to try to remember if I ever calculated that.

I'm not sure that I ever would have done that calculation other than obviously to verify compliance with the 95 to 105 rule.

Q. And you didn't report that in your report, right?

A. Not to my recollection.

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Q. Do you know what the maximum deviation was? Was it 10 percent?

A. Oh, well, I think that the maximum deviation should be 5 percent. The point is you can go all the way up to 105 --

Q. I might not have been clear.

The maximum deviation in the simulated plans ran all the way from 95 percent to 105 percent? There were some plans with 105 percent, some plans with 95 percent?

A. Oh, I see what you're asking. I'll try to be more precise to the best of my recollection.

I think the way the algorithm quantifies the 95 to 105 percent threshold is to say you must be over 95 percent and you must be under 105 percent.

Q. Right.

A. So if you are to look at the deviation between the smallest populated district and the largest populated district, it would be a little bit less than that total 10 percent band because I'm not allowing districts to be exactly 95 percent. I mean I think, I'm assuming 95 percent is actually a fraction, I assume. There is probably a fraction of a person in that number.

But the point is that I'm requiring over 95 and under 105 percent to the maximum. So the total range of the deviation will be a little bit under 10 percent. I really couldn't give you whether it's 9.9 or 9.8 percent. And

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obviously that number I'm sure differs from plan to plan.
Q. Did you check whether there was a partisan pattern in the over and under population? For example, were the more Republican districts overpopulated relative to the Democratic districts?
A. To my recollection, I never checked that pattern that you're describing there, saying was there a correlation between, say, more underpopulated districts and whether those districts were more Democratic and more Republican.
I would say that the only extent to which I'm aware that there could even potentially be such a pattern, to my knowledge, would be, say, obviously I understand that we got certain tighter population thresholds for the Detroit districts. Obviously we know that Detroit districts are more Democratic leaning, and so maybe there could be some kind of correlation there in so far as all of those districts are required to be tightly populated, something like that.
It's not something that I have systematically analyzed. But obviously I'm not able to tell you that there is or is not a even small correlation along those lines.
Q. Okay. And how did you deal with the issue of island townships, that part of the township is wholly within another township, how did the algorithm deal with that?
A. Okay, sure. I'm going to answer that as completely as I can. I'm going to start by giving you the basis of my answer,

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which is the details of how I dealt with those township islands, islands within cities, is all captured and performed in my computer code that I turned over.
Now having said that, I'm going to try to do my best to try to answer this succinctly without going into too much detail here, and to the best of my recollection.
So in general -- and I'll speak generally for all three sets of simulations, at first. In general, what the code does is my computer code was written to, first, take a noncontiguous township island that are not contiguous from say the main portion of the township, and divide them apart, separate them apart into separate polygons.
The background for this is that the shape file for the municipalities that I started with treats every single municipality as a single polygon in the shape file, that it is a single row by itself. It has the entire land area of the township, with all of its noncontiguous portions encapsulated in a single row, in a single polygon, in a single row of the shape file.
Now obviously that means, for example, Ann Arbor Township would be a row consisting of some noncontiguous parts. So what I did, and my computer code did was take them apart and divide them into separate polygons, each of which itself is contiguous. So take those islands and separate them apart.

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Now having separated them apart, they can be treated as a base building block for the simulation so that you can adjoin together those things and not accidentally end up with a noncontiguous district, which is the whole point of having to separate them apart.
So in general, that's what I did, I separated them apart.
So, for example, Michigan starts with having, I believe, I'm going to try to get the number right, I think it's 1,573 municipalities. Obviously some of them are townships with islands. So I separate apart those islands and you end up with more than 1,573 polygons in the end because I've separated apart the township islands from many of the townships. So I separate them out and treat them separately.
Now obviously in the end I have to come back and treat them as a single township for the purpose of counting or identifying municipal breaks. But just for the purpose of producing a simulated plan, the computer code separates them apart and treats them separately.
So that's in general, the approach that the computer code takes.
There are then ways that specifically I dealt with this with respect to the House simulated plans. So after separating the noncontiguous portions of the township

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islands, in all of the townships, there were certain townships -- there were certain municipalities where I took township islands and integrated them back together with the city surrounding that township.
So an example is Ann Arbor Township has a large number of islands, and Pittsfield Township has a large number of islands within the City of Ann Arbor. I think the same is true of Kalamazoo Township which has a number of noncontiguous islands, and some of them are wholly within the City of Kalamazoo.
And for those cases, I took the township islands, say Ann Arbor Township islands, and integrated them, merged them together with the, in Ann Arbor Township -- in the case of Ann Arbor Township, it was the northern portion of the city of Ann Arbor, and for Pittsfield Township it covers the southern portion of Ann Arbor.
I merged it together. And the reason I did that was to allow the algorithm the opportunity to possible see if it was going to be geographically and mathematically possible to create plans that keep, say, all of Ann Arbor Township together or all of Pittsfield Township together without separating the township islands from each other.
So those were the different ways --
Q. Can I just follow up on that?
A. Sure.

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Q. I just want to ask something specific about that.
A. Okay.
Q. Because I think I may have lost your thread.
If it was mathematically and geographically possible was the algorithm instructed to, for example, keep the Ann Arbor townships together?
A. Yes, it treats that as a township that needs to be kept together, otherwise it might count as a municipal break.
Q. Okay.
A. So the algorithm, in trying to keep townships together, it tries to keep all the noncontiguous fragments together.
And I'm aware that in some cases, it is just mathematically impossible to, but in general I set it up so the algorithm has the opportunity to try and do so.
Q. And that would -- for the goal of minimizing the township and city breaks?
A. Correct.
Q. Okay. Did you review the 1982 correspondence between Mr. Apol and the Supreme Court Clerk Pogue and the Supreme Court Justice Charles Levin on the Apol criteria?
A. To my knowledge, to my recollection I am not aware of that correspondence.
Q. Okay. If you could turn to page 40 of your report, please?
A. (Witness complied.) Yes.
Q. So I'm just really trying to make sure we're talking about

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the same things here and this is just an illustrative example.
You have a number of county breaks, this is for the enacted plan, you say 17 county breaks?
A. Let me just --
Q. Do you see that on the left-hand side?
A. Yes, sir. I see that.
Q. Okay. So I'm just trying to figure out, does that mean a district line broke a county line? What I'm getting at, what if a district line broke the county line twice, the same county, would you count that as one or two breaks?
A. If a district line -- if a single district --
Q. If there was ambiguity in my question, I apologize.
No, let's assume different districts broke -- or the same district broke a county line twice, in two different places, would you count that as one break or two?
A. I see. I'm going to ask those two questions separately.
If it's two different districts causing, each causing a county break of the same county, my recollection is I would call that -- I would count that as two separate breaks. I can't give you an example off the top of my head, but I think I wrapped my head around that sort of situation you're describing.
Q. Okay. And the second --
A. I got your second part of your question.

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Q. Okay.
A. So if it's a single district, but it breaks the county in two completely separate noncontiguous -- two completely different places of that county, I think that's what some people would refer to as double traversal of that county, you kind of intrude into the county but at two completely different places that don't touch one another except through another county, that I counted as a single break, not two separate, not an additional county break, but rather one single county break.
Q. Okay. And then right underneath that you see, the number of counties divided into multiple districts.
Again, I'm just trying to clarify, would that mean if, for example, a number of districts were wholly within the county but never broke a county line, would that show up in that tabulation, that 28?
A. Yes. And that's why you see including Wayne County there, so obviously you're going to have to break Wayne County, obviously you're going to have to break Washtenaw County. Obviously there are several counties that inevitably will show up on this list. Again Wayne County counts as one county that is divided into multiple districts.
Q. Do you think that's a relevant criteria under the statute, how many districts you have within a county, if it doesn't break a county line?

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A. Do I think it's a relevant criteria for the purpose of interpreting the statutes, for what purpose?
Q. Do you think the statute speaks to the question of how many, the number of districts are within a county without breaking a county line?
A. Okay. I would recognize that the statute does not have an explicit mention of this sort of number of counties divided into multiple districts the way that I calculated that.
Q. So what information are you conveying on this chart with that column, that row?
A. The column conveys -- that row conveys exactly what I described.
Q. I know, but do you think it has any relevance to compliance or adherence to the statutory criteria?
A. That's a legal question that I'm not qualified to answer. I'm just explaining what I did.
Q. From the -- wholly apart from legality, do you think it reflects any divergence from or adherence to what your understanding of the statutory criteria are?
A. As I said, I recognize that the statute does not have an explicit section or line that defines number of counties divided in the way that I operationalized it and quantified it here.
Q. Okay. If there is a choice between breaking a county line a second time, or breaking a different county line, what did

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the algorithm require?
A. I want to try to understand your question. If there is a choice between breaking a county line a second time --
Q. Right.
A. -- versus breaking another completely different county.
Q. Right.
A. Okay. So I think the first choice that you're giving there is what we were discussing before, what I had said some people might call a double traversal.
Q. Right.
A. And as I said since my computer code calls that a single break, that would be treated as more preferable to the second scenario where you're saying you're going to break a whole another county, a completely different -- a completely different county.
So if I'm understanding the question correctly there, the first would be what is prioritized in terms of decreasing or minimizing the number of county breaks.
Q. Okay.
A. Obviously the caveat being all else being equal, nothing else being violated, no population equality being violated, etcetera.
Q. On page 40, you just referenced the point that the number of counties divided includes Wayne County. But if you turn to page 27 of your report that's dealing with the Senate plans,

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you exclude Wayne County from that. Why is that?
A. Well, I just wrote those lines in there to make clear exactly what I was counting and how I was counting them.
As to why I did it one way in one table and another way in the other table, I mean first of all I was just trying to be transparent and explain clearly what I was doing, even if it was slightly different for these two tables.
In general, what I did in -- I think I'm going to start with the Senate table, which is the page 27 one you referred to. What I did in the Senate plan was I froze districts one through seven from the enacted plan, all seven districts covering the entirety of Wayne County.
And what that means is that Wayne County is effectively excluded from the simulation process, all of Wayne County is. And so we all know what happens in districts one through seven. Wayne County is obviously divided into multiple districts.
So it really doesn't matter if you want to include Wayne County or you don't want to include Wayne County. If you want to include Wayne County, add one to everything; or if you don't want to, subtract one, and that's what I reported. The point is to do an apples-to-apples comparison when I'm comparing the enacted plan to the computer-simulated plan.
But I guess in this particular case, I just -- my

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recollection is that I excluded Wayne County from the number of divided counties because Wayne was just not really even a part of the simulation process in any random sense, since all of Wayne County was carved up in exactly the same way due to those frozen districts.
Now turning to the other table you referenced on page 40, that's Table 4 describing the enacted House plan and the computer-simulated House plans, you noted that I did include Wayne County in this, in this count.
And the point here is that I was not freezing every single district, every single House district within the boundaries of Wayne County. The computer code froze many of them, but not all of them. So there was actually some real simulation process going on in some parts of Western Wayne County. So I included them.
Again, it's not particularly meaningful if you do or not. The point is just to do it consistently so there is an apples-to-apples comparison when I'm comparing the enacted House plan to the computer-simulated plans. And in this case I chose to include Wayne County which meant that there was going to be one more county, Wayne, that was divided in both the enacted House plan as well as the computer-simulated plans.
The broader point is as long as you're doing an apples-to-apples comparison using the same rules for the

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enacted plan and the computer-simulated plans, that's what really matters here. Obviously Wayne County is always going to be divided up in any equally populated plan that you can draw for Michigan's House district. So it's really just adding one to both columns there.
My recollection is that's generally why I included Wayne County here but not in the other, in the Senate table.
Q. One last question on how you count county breaks.
So if you have, if district one and district two split county line between Smith County and Jones County, okay? In other words all of district one is composed of parts of Smith and parts of Jones, all of district two is composed of parts of Jones and parts of Smith County, do you follow so far?
A. Yes.
Q. Okay. I assume from your prior answer, that's one -- you count that as one county break?
A. And just to clarify you're telling me that neither district one or two cover any parts of any other county other than those two?
Q. That's the key point, correct.
A. I got you, let me think about that.
I'm going to give you my best shot at answering that and I'll start by qualifying it by saying that when I counted up the county breaks in all the 3000 simulated maps,

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obviously I wasn't doing it by hand, I was doing it by computer code and that computer code contains the rules that I used, contains the instructions that I used to count county breaks. So it's all in that computer code that counts county breaks.

So what you're asking me to do here is to count, not by hand, but by thinking hypothetically about hypothetical counties, and I'll do my best, but I want to qualify by saying this is obviously not the sort of process I went through in my report to calculate county breaks.

So as I think I understand the district one and two Smith and Jones County situation you're setting up, that sounds to me, as I'm sitting here just thinking about it in my mind without any sort of visualization here, that sounds to me like -- that sounds to me like that's two separate county breaks. It could be thought of as Smith being shifted into Jones or Jones being shifted into Smith for both district one and district two, and so that sounds to me like two different county breaks.

Q. Okay.

A. But again same qualifications as before. I'm just visually thinking about this sort of removed-from-reality hypothetical here.

Q. Well to follow up here though on your qualification, these issues do arise in the real world. Do you have a specific

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recollection of what instructions you gave to the algorithm in these sort of circumstances when the computer is tallying up county breaks?

A. Well I can tell you the sort of prioritization the algorithm would inevitably give to a situation like that, because of how it's trying to minimize county breaks.

Inevitably, I'll stick with your example, either Smith or Jones County has the larger population of the two. And if we're talking about House districts, obviously those two counties have to sum up to roughly 180,000 or so in population because they're going to include fully two districts. And I think you're qualifying, I believe, correct me if I'm wrong, that there are no other districts within these two counties, within Smith and Jones.

So those two counties have to end up summing up in total population somewhere around 180,000 in population to be two full House districts.

I know you didn't specify House districts, but I'm adding to your hypothetical here.

So what the algorithm would do is it would try to only -- to draw those districts by only splitting up one county. Let's suppose that Smith is the bigger county in terms of population and Jones is the smaller county in terms population. That definitely means you would be able to fit a full House district within Smith County, and then the

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remaining population of Smith would have to be combined with all of Jones for the second House district.

That sort of configuration is the sort that would be prioritized because, as I'm thinking about that hypothetical, that would be one county break. That's just a shifting of a small part of Smith into Jones.

And so that would be the sort of configuration that would be prioritized when you're trying to minimize county breaks.

Q. I don't want to explore that hypothetical too far.

That's true however, if Smith is not big enough for the district, it has to go somewhere to get extra population. One choice is to go into Jones to get the extra population, and whatever you take out of Jones you leave enough in Jones that if Jones went into Smith for the second population, that would be the county break.

If you didn't do that, then the excess population in Jones would have to go to another district to get its population. Do you follow what I'm saying?

And I'm just trying to figure out what the algorithm told it to do in those circumstances.

MR. YEAGER: Objection, incomplete hypothetical. Assumes facts not in evidence.

You can answer.

THE WITNESS: Okay. I'm not sure if you are

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starting to talk a somewhat different hypothetical than what I was talking about a moment ago.

What I was saying is that if it is the case that these two counties, Smith and Jones combined together are roughly the size of two House districts --

BY MR. CARVIN:

Q. Right.

A. -- then the sort of configuration that the algorithm, that the code is going to prioritize is one in which one of the two districts is fully within the larger of the two counties. And then the smaller of the two counties will obviously have to be combined with the remaining portion of the larger county.

And then that would be one total county break, so that would be prioritized.

Q. Okay. Now assume with me that district one and district two share the Smith and Jones County population, but district one also goes out and gets a third county, whole county, how many breaks does that count?

MR. YEAGER: Same objection.

You may answer.

THE WITNESS: I'm starting to have a little more trouble following along. Is it all right if I take a pen and paper and try --

BY MR. CARVIN:

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Q. I will try it again.
A. Okay.
Q. We were initially talking as you just mentioned between Smith and Jones sharing all of the populations of district one and two, but now one of the districts is underpopulated, so it goes out and reaches out and gets Johnson County, okay, as well.
And I'm wondering if that changes the amount of county breaks that your computer would count.
MR. YEAGER: Objection, incomplete hypothetical and the witness has asked for paper.
Would you like me to give him some?
MR. CARVIN: You can give him all the paper you want.
BY MR. CARVIN:
Q. Go ahead.
A. I'm going to try and write down what you said here.
We've got Smith County, and we've got Jones County. And if I'm understanding you correctly, districts one and two comprise -- it would comprise all of Smith and Jones County, have I got that right so far?
Q. You do.
A. All right. Now can you go to the last part of your question where you brought in Johnson County?
Q. Under that hypothetical district one is underpopulated, so it

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goes out and reaches and brings in all of Johnson County which brings it within the population threshold. You're not breaking Johnson County line, but you're adding it to the district one you just described.
Does that count as an additional county break or do you tally them up the same way as you would have under the original hypothetical?
MR. YEAGER: Same objection.
You may answer.
THE WITNESS: Okay. I think your question is does going out and grabbing Johnson County count as an additional county break?
BY MR. CARVIN:
Q. That's exactly right.
A. Okay. I'm going to try my best to answer your question. I'm going to first start by qualifying that this seems like such a nonideal situation in terms of optimization of county breaks that it's not the sort of situation that I, to my recollection, I remember seeing in, say, the simulated maps that I analyzed.
So my understanding of the situation is that we've got one county break involved with district two, just as before; and then we've got two county breaks involved with district one. So that's a total of three breaks.
And that's -- I'm not sure -- I'm not sure I

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totally have all the information I need here, but I think I'm able to understand what information you've given me here so far. And so that's my best shot at it.
Again I'll qualify all of this by saying that obviously getting a pen and paper here and doing these little hypotheticals like I'm trying to do right here is not at all how I actually counted breaks in my computer code. Obviously I've programmed the computer to follow a series of steps to calculate county breaks. But I'm giving you my best shot here.
Q. But wouldn't the way the computer code counts the county breaks conform with your understanding of how to count the county breaks?
A. To the best of my knowledge.
Q. Okay. If you could turn to page 64 of your report, please.
A. (Witness complied.) Yes, sir.
Q. Okay. So it states, does it not, the simulation algorithm thus seeks to achieve compactness where required only after prioritizing the four aforementioned criteria. The algorithm, after doing the four, then favors districts that minimize the Michigan land area inside of each district's circumscribing circle but outside of the district itself.
Is that correct?
A. Yes.
Q. Okay. And that is the measure that is specified in the

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statutory criteria?
A. I tried to -- the criteria is a little -- is maybe -- it's a little bit general, but I tried to faithfully follow what I saw in the criteria in describing this unique sort of compactness quantification that I saw in the statute.
Q. And that's the first measure that you did, but you also did the Reock score in addition to that, right?
A. That is -- well I calculated the Reock score of the districts.
Q. Okay. And you used that even though it's not in the statute for what reason?
A. Why did I use the Reock score?
Q. Yes.
MR. YEAGER: Asked and answered.
You may answer.
THE WITNESS: I think I said earlier this morning I calculated it because it's something -- it's something that I believe I almost always do when I evaluate the compactness of districting plans, enacted plans and computer-simulated plans.
BY MR. CARVIN:
Q. If you'd turn to page 40.
A. (Witness complied.)
Q. Okay. Let's start with the Reock score, because that's more commonly used.

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The Reock score for the enacted plan is 0.415. Is there any consensus or dominant view within the political science community on what Reock score would render a plan non-compact?

A. My sense of a general view, and at the very least I'm speaking for myself here, and obviously again, it's not something I've ever taken a survey or a poll on, but there is not really a one-size-fits-all answer that will tell you, say, a .5 is a great score and a .2 is a bad score.

When it comes to Reock it's context dependent and geography dependent. And you can easily see that if you imagine, for example, what sort of Reock score one would get if you were to draw some districts in the State of Hawaii, or say Alaska's Aleutian Islands and then calculate the Reock score by fitting an abounding circle around those districts.

Of course the sort of Reock scores that one could reasonably expect from a districting plan in Hawaii or the Alaskan Aleutian Islands would be just of a completely different nature than if you drew, say, a district involving the State of Wyoming, which is just a perfect square. The state is a perfect square. And say if you were drawing Wyoming into two districts, you could expect some pretty compact, pretty good Reock scores.

But obviously if you're doing that in Hawaii, you're going to expect a completely different sort of Reock

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score.

So I think the consensus is that it really is jurisdiction dependent or context dependent. In other words what we can say about a good Reock score that makes for, say the sort of plans that were clearly prioritizing compactness, what sort of Reock scores would indicate an effort to try and prioritize compactness in Wyoming is completely different than the sort of Reock scores that one would expect to see typical plans drawn in Hawaii.

That's what I mean by it's context dependent. And I think that political scientists who study redistricting recognize that for the most part that you're dealing with different geographies.

Q. So there is no general benchmark under the Reock score, it's geographic specific. So for example the Reock scores for the House are from .418 to .435, would you suggest that that is the benchmark from separating a compact plan from a non-compact plan?

A. No. I don't think I'm opining that at all.

Q. You're just telling us that the enacted plan is less compact under the Reock score than the simulated plan?

A. That I'm definitely saying just as a purely statistical matter.

Q. Right.

A. It's -- it's not as if -- and certainly looking at Reock

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scores makes clear there is no such thing as an either or when it comes to compactness. It's not as if there is a magical cutoff that turns a district from being non-compact into compact or vice versa.

The point here is that this is the range, this is the general range of scores that one can expect from a computer simulation algorithm that is prioritizing compactness in the way that I'm trying to do here.

Q. And .415 is outside that range?

A. Yeah. Mathematically or statistically it's outside that range.

Q. Right. And I get that statistically. I'm wondering as a matter of political science or otherwise, is it a significant difference? Is there any real difference between 0.415 to a 0.418 in terms of the goals that redistricting plans are designed to achieve, are you opining on that?

A. Well I'm certainly opining that it's statistically different, obviously.

Q. Right.

A. As to whether this can be characterized as a really, really severe or just a sort of small sacrifice, that's not really the sort of thing that I'm quantifying here beyond just reporting the numerical numbers here, and describing the results in terms of here is the statistical properties of distribution. This score is a statistical outlier, extreme

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statistical outlier.

But I'm not actually taking that statistical conclusion and telling you, for example, that this somehow proves that compactness was only factored one-fifth as much as it should have been or anything like that that would say anything more substantive than just the statistical properties that I've described.

Q. Can you cite an article or a case which has ever attributed significance in a substantive way to the kind of differences we see between 0.415 and 0.418 to 0.435?

A. Well obviously you're giving specific numbers and I'm sure there has never been a scholarly number that has precisely these --

Q. That's a very literal interpretation of my question. Let me do --

A. I get your question and --

Q. Let me rephrase it since you're going to interpret it literally.

Have you ever seen a case or scholarly article that ever ascribed substantive significance to the kinds of differences reflected on page 40 between the simulated and the enacted plans?

A. Sure. I get the general question you're asking me, you're basically asking me if anybody has ever used this method, this abstract method of comparing.

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Q. No.
A. Okay.
Q. Let's assume it's one alternative plan versus another and they have differences analogous to those between the simulated plans and the enacted plans. Has any Court ever suggested that that's a significant or meaningful difference in compact --
MR. YEAGER: Calls for a legal conclusion.
You can answer.
THE WITNESS: I was just going to say that obviously I'm not qualified to tell you if a Court has interpreted something one way or another way.
BY MR. CARVIN:
Q. So you're unaware of any Court cases that have done that?
A. Not to my knowledge.
Q. Is there any scholarly article, which is in your area of expertise, that has attributed any substantive significance to the kind of differences between the enacted plans' Reock scores and the Reock scores expressing the range of the simulated plans?
A. Okay. That was a little bit of a different question than what you asked previously. So I'll answer that question now.
And the answer is, yes, I have done so in my scholarly, in my peer review and academic work.
So, yes, I am aware.

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Q. Anybody besides you?
A. You know, if you're asking has there been another article that uses some kind of computer-simulation redistricting algorithm and does all, does these sorts of things where you draw a bunch of alternative plans and compare it to an enacted plan, in general I would say that, one, there is just not a whole lot of literature doing that.
Q. So the answer is no?
A. Well I'm going to answer your question.
Q. Maybe if you could answer it yes or no and then explain, that would be good.
A. Okay. I appreciate that.
I'm not specifically aware. It's possible that it has happened and it's possible it has not.
Q. Let's take out the simulation from the hypothetical.
MR. YEAGER: I object, he wanted to give a longer answer. You said he could answer yes or no and then explain, so are you going to let him explain?
BY MR. CARVIN:
Q. Sure.
A. I was just going to briefly qualify that. It's not as if there is decades and decades of peer-reviewed articles doing exactly this sort of method that I'm doing here.
Q. Okay. So let's take that out, forget the simulated plans.
Alternative plans that reflect roughly the Reock

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scores that you found in the simulated plans versus an enacted plan, has any scholarly article attributed substantive significance to that difference?
A. Enacted plans to an alternative plan is what you're asking about now?
I can't specifically think of one off the top of my head, but I really don't have much doubt, given what I generally know which is that there is lots of literature describing say the Reock scores, the Polsby-Popper scores, etcetera, of various districting plans, I have no doubt that there certainly have been articles that compare one plan to another.
Now was it specifically an enacted plan versus a computer-simulated plan, or a plan proposed by somebody that was not officially enacted? I don't know that I can specifically answer that precisely or if I could specifically recall of an instance like that. But I don't doubt in general that there has certainly been articles that have compared one plan to another along Reock or Polsby-Popper or some other similar measure.
Q. And in those articles does it say a difference, analogous to the difference between the enacted plan and the simulated plans would be substantively significant?
A. I'm going to have you ask that again.
Q. Would the differences in the Reock scores between the enacted

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plan and the simulated plans would be substantively significant, any such articles?
A. I'm still not sure that I understand the question.
Q. Are there any articles which suggest the differences analogous to that between the enacted plan and your range of the simulated plans would be substantively significant?
A. Okay. You're talking about the difference that we're seeing here on Table 4 on page 40, have I got that right?
Q. Yes.
A. Okay, I got you, I misunderstood what you were asking about earlier.
MR. YEAGER: No, you understood.
THE WITNESS: I can't specifically recall that. I'm sure that there have been articles talking about differences, calculating mathematical differences between two different plans in terms of their Reock score.
I can't really give you precisely what those authors might have said about what -- their opinion about what a significance difference is. I can't specifically recall.
BY MR. CARVIN:
Q. How does a 0.415 Reock score compare generally to the compactness of Congressional plans throughout the nation, do you know?
A. Throughout all 435 districts is what you're asking --

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Q. No, I didn't think you were giving me Reock scores for individual districts. You were giving me for the entire Congressional districting plan. How does 0.415 stack up among analogous Congressional districting plans in the United States, do you know?

A. It's not something I've thoroughly analyzed. I can generally say, as I said sometime early, that obviously Reock scores are very context and geography dependent.

So I can say for example, with pretty good certainty, that say a .415 is a low score in comparison to Wyoming's Congressional district. That I'm comfortable guessing about even though I've not specifically calculated the Wyoming Reock score.

And I'm also pretty comfortable saying --

Q. Do you know how many Congressional districts there are in Wyoming?

A. There is one.

Q. So at this point you're being facetious?

A. No. I'm just --

Q. I just want to know at this juncture do you have any sense of where this stacks up among comparable redistricting plans?

A. Okay, comparable --

MR. YEAGER: Objection, characterization.

You may answer.

THE WITNESS: Okay. So comparable redistricting

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plans. I'm just going to -- I'm trying to understand the question as best as I can.

BY MR. CARVIN:

Q. No, you're not. But go ahead.

MR. YEAGER: Objection. I object to the characterization. The witness is answering your questions to the best of his ability and it's inappropriate for you, Counsel, to make comments on what he's trying do. He's trying to answer your questions to the best he can.

If you ask a clear question, and, yes, he will take you literally, and he will give you a clear answer.

And I really object to your making comments about his intent that they're inaccurate and they're inappropriate.

Now if there is a question on the table, you can answer it; if there is not a question on the table, let's wait for a question.

THE WITNESS: So I think you just clarified by talking about comparable districting plans. You didn't say exactly what comparable means but I'm going to -- I think you could say comparable in terms of the number of Congressional districts. So if there were other states that had 14 or say close to 14 Congressional districts.

And my answer there is even then, it's still very context dependent, very geography dependent. Obviously a state like North Carolina has 13 Congressional districts,

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very similar to the number of districts in Michigan. But North Carolina's geography, underlying geography is quite different from Michigan. Michigan has a lot more coast line than North Carolina does.

So I'm not sure that comparing Reock scores from Michigan to North Carolina would be terribly helpful.

But my overall answer to your question is in the context of that kind of stuff, I haven't down that kind of study. I haven't really tried to identify states comparable to Michigan and directly compare the Reock scores. I'm not sure that such a study makes much sense to me.

BY MR. CARVIN:

Q. All right. Could you turn to page 64 of your report, please?

A. (Witness complied.)

Q. Okay. And this is sort of repeating what I read to you before. But just to confirm, after the algorithm takes care of the first four factors, the algorithm then favors districts that minimize the Michigan land area inside of each district circumscribing circle but outside of the district itself.

Is that right?

A. Oh, it favors districts that are more compact.

Q. Right. And are you suggesting that the statute favors or requires minimizing Michigan land area inside of each district's circumscribing circle?

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A. I'm not giving an opinion about what the statute legally requires or doesn't require.

All I'm doing, obviously, is reporting to you -- reporting here on what I actually did in the algorithm.

Q. Right.

A. So I'm describing how I operationalized the criteria that I understood.

Q. And you're not suggesting that your, how you operationalized the criteria reflect what the statute uses as operational criteria, right?

A. Well I certainly read the statute. But I am not giving an opinion on whether a particular reading of the statute that I operationalized it as is legally required or is prohibited or some other legal judgement. I'm just telling you about what I did, how I operationalized the criteria that I read.

Q. So you're not in any way opining that the statute favors districts that minimize the Michigan land area inside of each district's circumscribing circle, right?

A. I'm not opining on whether something is legally required or not.

Q. Or whether the statute encourages that?

A. You're saying encourages the legislature? Have I got that right?

Q. I'm just trying to figure out why you put this into your algorithm.

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A. Okay.
Q. This idea of minimizing the compactness. If it doesn't come from the statutory criteria, I assume it's your own personal idiosyncratic view of redistricting. Am I wrong about that?
A. What I said is that I have no view as to whether the statute requires or even encourages in any legal sense. Obviously I'm also telling you about what I did in my own computer code. And I'm saying that I understood the criteria, and I operationalized the criteria in this particular way.
Q. Was your personal --
A. So I --
Q. -- understanding of the criteria that you needed to minimize the compactness --
A. If I could just finish my answer to the question.
I am just saying that this is how I operationalized it. And so I don't know if that -- I don't really reach any conclusion regarding, say, require or encouraged beyond this is what I did to operationalize it.
I apologize for interrupting you.
Q. Did you do that because your understanding was that the statute encouraged line drawers to minimize the Michigan land area inside of a district's circumscribing circle after taking account of the first four criteria?
MR. YEAGER: Asked and answered.
You may answer.

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THE WITNESS: I didn't take any opinion -- I don't have an opinion on how the statute affects line drawers, which is the term you just used.
BY MR. CARVIN:
Q. Why did you do it in your algorithm?
A. Why did I prioritize compactness, why did I pursue compactness?
Q. In the way -- yes.
A. Okay, sure. And the answer is the same with respect to compactness as with respect to the other criteria that I operationalized in my code.
I read the statute, I consulted with Plaintiffs' counsel, and I determined the criteria that I was going to computerize or build into the computer code.
Q. Did Plaintiffs' counsel tell you that the statute encourages minimizing compactness in districts?
MR. YEAGER: Well I'm going to object.
You can testify as to what instructions you were given. I'm going to object to, and instruct you not to answer as to discussions that may have occurred with counsel that are protected by Rule 26 and work product outside of whatever instructions you were given.
You may answer.
THE WITNESS: I can't answer your question and follow Mr. Yeager's instructions to me.

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BY MR. CARVIN:
Q. Were you instructed to create districts that minimized or maximized compactness as you described it in your report?
MR. YEAGER: You may answer that question.
THE WITNESS: Okay. My understanding of my discussions with Plaintiffs' counsel was that compactness was to be pursued in the way that I prioritized it here, which obviously again is beyond the -- beyond the first four criteria that we've mentioned earlier. That beyond that, districts are to be favored when they're more compact rather than less compact.
So that was generally my understanding of what I was going to analyze.
BY MR. CARVIN:
Q. Okay. But that's not your understanding of what the statute encouraged? You were doing that because Plaintiffs' counsel told you to do that, not because you had any independent view that that's what the statute encouraged, right? Do I understand that correctly?
A. To the best of my recollection, that's correct.
Q. Okay. We can go through it, but there is nothing in -- and you can review this all you want, in either the congressional or state legislative statute, is there, that says you favor districts that maximize compactness after the first four criteria have been satisfied, right?

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A. My understanding is that there are portions in the statutes where drawing -- where maximizing compactness is explicitly called for in some circumstances.
Q. Yes. Let's identify those circumstances.
If you look to the 1999 plan on congressional redistricting, if you look at (c)(vi), it says, within the city or township to which there is apportioned more than one Congressional district, district lines shall be drawn to achieve the maximum compactness possible.
So in those circumstances the line shall be drawn to achieve the maximum compactness possible, right?
A. I see that.
Q. Is there any other circumstances where the statute references maximum compactness of districts or lines?
A. Well I see that right after that there is a general provision on compactness and how one is to understand compactness.
Q. All right. In addition to -- I'll repeat it. In addition to (c)(vi) is there any other part of the statute which requires or encourages drawing districts to maximum compactness?
MR. YEAGER: Objection, calls for a legal conclusion.
You may answer.
THE WITNESS: I can't give you an expert opinion on what the statute requires or encourages. I can tell you about the words on the statute.

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BY MR. CARVIN:
Q. Okay.
A. And if that's all you're asking about, I can affirm for you that there is not another place other than where we've just read from that says maximize compactness.
Q. And the one you referenced, because you are able to read the statute, simply tells you how to determine compactness. It doesn't say that they favor compactness relative to other alternatives, right?
A. I see that it just -- that next section just tells us --
Q. Right.
A. -- a quantifiable measure of compactness.
Q. Right. And those are the only two references to compactness in the Congressional statute, correct?
A. Yes.
Q. Okay. We can look at the state legislative one, the act of 1996.
A. Okay.
Q. I can make this short or long. Doesn't it essentially say the same thing as the Congressional statute that we just went through?
A. I'm happy to tell you I'll give you all the same answers there.
Q. Okay, great.
All right. If you could turn to page 14 of your

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report.
A. I just want to point out if there is an opportunity for me to use the restroom, I'd be very appreciative.
Q. Can we go three more minutes?
A. Sure.
Q. I have a few more questions, but just generally whenever you need to take a break, Professor, just raise your hand.
MR. YEAGER: Is that okay, three more minutes?
THE WITNESS: Sure.
BY MR. CARVIN:
Q. Okay. This page, I'll give you a chance to review it, discusses the differences between the compactness of the enacted Congressional plan and the other plans. And we've already talked about the differences that we identified.
A. I just want to -- I want to orient myself, we're on page 14?
Q. Yes.
A. Which paragraph?
Q. I'm about to direct your attention to the prior paragraph but I want to make sure you understand the context I'm about to read. So please take your time to read the preceding paragraphs.
MR. YEAGER: I didn't catch that.
BY MR. CARVIN:
Q. Please read the two paragraphs above the bottom paragraph to make sure that I'm not misleading you about what the bottom

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paragraph is talking about.
A. Okay, I gotcha.
Q. The first finding is that the enacted plan is more pro-Republican than the simulations. Is that correct?
A. That is generally what I'm describing in that third-from-bottom paragraph.
Q. And then the Congressional plan is outside the compactness range of all thousand simulated maps, right?
A. I see that in the next-to-the-last paragraph.
Q. And from that you conclude, these findings suggest that the enacted Congressional plan was drawn under a process in which a partisan goal, the creation of nine Republican districts predominated. I am thus able to conclude with over 99.9 percent statistical certainly that the enacted Congressional plan created districts less compact than what would have reasonably emerge from the districting process not driven by partisan intent. Is that your conclusion?
A. Yes, I see that.
Q. Okay. Well, the basis -- what is the Reock score that, or circumscribed scores that would have emerged from a districting process not driven by partisan intent?
A. Okay. What I mean in that last sentence is a process -- a process that I simulated, that I programmed using my computer code, that's what I'm referring to when I'm talking about a districting process not driven by partisan intent.

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Q. And it was also a districting process that was driven by a command to favor the most compact districts, right?
A. I am favoring compactness as one of multiple criteria, we've talked about this before.
Q. Right.
A. Obviously there is a hierarchy of priority, and I think we talked about that before.
But I think I understand your question. You're asking what sort of compactness scores would emerge under such a nonpartisan process such as my computer -- my computer algorithm.
Q. A nonpartisan process that didn't maximize compactness, might well have produced a Reock score similar to the enacted plan, correct?
A. A nonpartisan process that did not maximize compactness, that did not pursue compactness as one of those five goals?
Q. Yes.
A. I did not analyze that, so I really can't give you an expert opinion on what sort of compactness scores would have emerged if my algorithm had completely ignored compactness. Because you're asking me about essentially a compactness-blind algorithm, not necessarily one that disfavors compactness, but is just completely blind. That's an empirical question, I haven't tried to answer that --
Q. Have you tried to ask the empirical question that sort of

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favors compactness but not as much as your algorithm? Wouldn't that be another explanation for why it departs from the Reock and the other scores produced by the thousand simulated plans?

A. In general I'm not really sure by what's meant by sort of favoring compactness but not totally, whether that means favoring compactness, but only in odd number districts, something like that. It's not something I've tried to analyze.

I wasn't interested in what sort of plans would emerge if only some districts were drawn to be compact, but others were not. I can't answer that.

MR. YEAGER: So the witness has asked for a break and it's been awhile. Can we take a break?

MR. CARVIN: Yes. Thank you.

(At 2:17 p.m. went off the record.)

(At 2:28 p.m. went on the record.)

MR. CARVIN: Back on the record.

BY MR. CARVIN:

Q. Just to follow up on what we were chatting about before the break, Professor, what is the basis for your assertion that the lower Reock and other scores in the enacted plan was driven by partisan intent rather than a decision by whoever drew those plans that they wouldn't maximize compactness to the extent that your algorithm does?

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A. Okay, I'll explain the basis of my answer.

I am comparing two situations here and putting together two sets of findings. And obviously I'm putting together findings regarding the partisan outlying nature of the enacted plan as compared to the computer-simulated processed plans.

And then I'm putting together that with my finding regarding the statistically outlying nature of the Reock score and the compactness scores as defined by the statutory criteria. And as we talked about sometime earlier today, those Reock and compactness scores that I calculated, so I'm putting together those two findings.

And I'm saying that it is -- how likely it is that the plan that we're seeing here was one that was produced by the sort of nonpartisan process that the computer was programmed to follow, and I'm finding that to be very statistically unlikely because of its partisan outlying nature.

So putting those findings together leads me to conclude that it's something to do with the partisan outlying nature of the plan, that was related to the statistically outlying nature of the compactness scores that I was reporting on.

Q. Right. But they could have lower or worse compactness scores simply because they didn't emphasize compactness as much as

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your algorithm, right?

A. I wasn't analyzing that hypothetical as a, say an alternative hypothesis.

Q. So the answer to me is, yes, it's certainly possible?

A. I have no basis for saying that it is or is not. I'm just telling you that I did not analyze that hypothetical that you're putting forward to me.

Q. But nonetheless, you wrote down in your report that you can state with over 99.9 percent statistical certainty that the enacted Congressional plan created districts less compact than that would have reasonably emerged from a districting process not driven by partisan intent.

A. Yes.

Q. Well what if it was a process that was not driven by partisan intent, but wasn't driven by compactness?

A. Same answer as before. That is not what, the analysis I'm referring to right here.

What I was saying before is that what I mean in that last sentence, when I'm saying emerged from a districting process not driven by partisan intent, I'm describing the process I programmed.

Q. So really what you're saying is that reasonably would have emerged from your districting process that was not driven by partisan intent. Is that right?

A. That's what I said sometime ago and that's what I'm saying

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now too.

Q. Okay.

A. What I'm referring to here is the analysis that I did comparing the enacted plan to the actual process that I modeled, that I programmed, and I'm drawing conclusions by comparing those two things.

Q. Right. So it would be accurate to say that you can conclude with over 99.9 percent statistical certainly that the enacted Congressional plan created districts less compact than what would have reasonably emerged from your algorithm, right?

A. That's correct.

Q. Okay. And throughout this report you make similar comments about you can state with 99.9 percent statistical certainty about the partisan intent of the line drawers, right? I can point it to you, but the one we just read is a good example.

A. Well I am --

MR. YEAGER: Let him ask a question.

BY MR. CARVIN:

Q. So the question is, you don't describe how you computed the level of statistical certainty. I'm going to assume that you did the sort of normal confidence interval analysis, the 99 percent confidence?

A. Well here it is a 99.9 confidence interval, but I think were both talking about the same thing.

Q. Right. So you look at the thousand simulated plans and you

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see the enacted plan as not within the thousand, so you can state to a very, very high degree of statistical certainty that that would not have been produced if somebody followed your algorithm?

A. Okay. Now that you've said that, I think we're talking about slightly different things.

Q. Okay.

A. I'd be happy to clarify that.

Q. Right.

A. It's not literally just looking at the middle 99 or 95 percent or whatever, and saying is the enacted plan within. That's certainly one thing that you can do.

But when I'm talking about statistical certainty what I'm specifically talking about are basic statistical tests that we would do to characterize a statistical distribution.

Q. Did you describe those statistical tests in your report?

A. I described the results of them by saying --

Q. Okay. It would be helpful if you'd listen to my question. Did you describe those tests in your report?

A. I only described the results of tests.

Q. Right.

A. I didn't describe, say, the underlying methodological foundations of those basic statistical tests.

Q. Okay. And would those differ in any way from the 95 percent

Page 155

confidence interval test? Would they tell you something more statistically?

A. A moment ago when I told you I thought we were talking about the same thing, then you asked another question and I realized you were actually talking about something a little bit different than the sort of statistical tests that I'm referring to.

I'm happy to go into in it in some detail here if you feel that's responsive. But I'll let you tell me what to answer.

Q. Well I'm trying to figure out exactly what you're statistically certain about and maybe we can come back to the test, right?

You're saying that your algorithm process was nonpartisan, right?

A. Yes.

Q. Okay. And your algorithm process adhered to be statutory criteria as you interpreted them or as Plaintiffs' counsel told you to interpret them, right?

A. As I operationalized them.

Q. All right. And you are you saying that that simulation is the only way you could do a nonpartisan redistricting plan not designed to enhance Republican representation?

A. No, I'm not testifying to that, I'm not opining on that. I'm not, say, coming up with an opinion to say here is an

Page 156

exhaustive list of all the possible ways one could produce a nonpartisan plan in compliance with these criteria.

I'm designing an algorithm as best as I can using the criteria that's put forth to me, that's all I'm doing here.

Q. Right.

A. I'm not giving you an exhaustive list of, say, if you had a commission draw a redistricting plan it would or would not be nonpartisan, or anything like that. I'm just describing my own computer process.

Q. And that is one subset of nonpartisan plans the way you did it, but it doesn't exhaust the universe of nonpartisan plans, right?

A. Sure. Obviously I recognize it as possible for a human to go out and draw a nonpartisan plan. And I'm not trying to somehow deny that that is a possible way to draw a nonpartisan plan.

Q. For example, a plan that disagreed with your interpretation to statutory criteria, but didn't consider partisanship, wouldn't be captured by your simulated plans, right?

A. Well to the extent that such a process might not be exactly the same as what I programmed in the computer code, obviously those could very well end up with slightly different districting plans.

Q. Sure.

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A. The point is obviously not that I am saying that this computer code is the exhaustive list of all possible ways, as somehow the only way that anybody could ever produce a nonpartisan districting plan.

Q. Okay. So then what is your statistical certainty analysis based on, whether it's the 95 percent confidence, other than a comparison of your simulated plans to the enacted plan?

A. Well it is actually just that, it's a comparison of a simulated to the enacted plan.

Are you asking me about the methodology or are you just asking me about the fact that I'm comparing simulations to the enacted plan?

Q. And that your levels of statistical certainty are based on comparison of the simulated plans to the enacted plan, which I think you just answered.

A. It is. What I was trying to clarify a moment ago is that I don't think you had quite correctly described the statistical methodology by which I'm arriving at, say, the statement on page 14 about 99.9 percent statistical certainty.

But I think you got it correct with respect to the fact that I'm obviously comparing simulated plans to the enacted plan.

Q. Okay. Are you contending that the thousand simulations are a random sample of all nonpartisan plans?

A. I was not even interested in characterizing the whole

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universe of all possible nonpartisan plans, especially if they're not drawn pursuant to the criteria that I am building into my computer code.

So that's not a question I would have been interested in seeking to analyze.

Q. So you didn't use any of the methods that people could use to figure out whether your thousand simulated plans are a representative sample of all potential nonpartisan redistricting configurations?

MR. YEAGER: Objection, assumes facts not in evidence.

You may answer.

THE WITNESS: Okay. Compared to all possible nonpartisan redistricting plans.

I don't know if your question is seeking to include even plans that are not drawn with pursuit of the criteria that I programmed into my algorithm. Obviously I was only trying to produce the sort of plans that followed the criteria as I've laid out in my computer code and as I've described in my report.

So I'm not interested in, for example, the broader set -- the broader universe of plans that are not drawn in pursuit of these criteria. It's just not something I analyzed.

BY MR. CARVIN:

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Q. Okay. And all of your plans have fewer county and municipal breaks then the enacted plan, right?

A. Are we talking about the Congressional?

Q. I'm actually -- you can look at them all, for the Congressional, Senate and House.

A. Okay. And you're asking about county breaks, right?

Q. Is it true that the enacted plan has more county breaks in all three plans than in your range of simulated plans?

A. I believe so, that's my recollection.

Q. Are you contending that they subordinated county breaks in order to achieve partisan end?

A. I'm not really contending anything. I'm just reporting on my findings and saying it seems clear from the findings that the enacted plan, for each of these three enacted plans was not drawn under a process like my computer simulation process, that was in fact prioritizing the minimization of county breaks. It's a statistical outlier in that nature.

I don't really read anything into it more than that, which is to say that it clearly was not trying to prioritize -- prioritize the minimization of county breaks because there is clearly a difference between that and the sort of computer-simulated plans that emerged.

Q. Okay. And I think you've clarified then that when you say that the plan was driven by partisan intent, that inference is based on the fact of the statistical difference between

Page 160

your simulated plans and the enacted plans, right?

A. Right. I'm comparing the partisanship of the enacted to the simulated plans.

Q. Okay. Did you look -- so let's go back, I guess, to page 40. This would be helpful.

So again, we've been over this, the simulated maps have 14 county breaks and the enacted plan according to you has 17, right?

A. Yes. I see that row here.

Q. Did you compare the number of county breaks or any of the other criteria in the enacted plan to the alternatives that were proposed during the legislative process?

A. You're referring to the plans that the legislature drew during the current decade's redistricting process, or proposed?

Q. Either proposed by legislators or anybody else.

A. I'm not sure that I've ever had access to those maps or those files. So to my recollection, I've not analyzed that question.

Q. So you don't know whether or not the number of county breaks and all the other criteria equal or exceeded the proposed alternatives that were available to the legislature at the time?

A. To my recollection, I don't believe I had the basis to answer that question. I'm just -- I'm trying to remember as

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accurately as I can.

It may have been that -- it may have been that Plaintiffs may have mentioned something very general about alternative plans that were proposed, but I certainly don't remember myself going and analyzing any such alternative plans.

Q. Okay. Have you analyzed -- assume with me that the map drawers for the enacted plan thought that their plan had the fewest number of county breaks, relative to all alternatives. And that your computer algorithm came up with a different way, a better way to minimize county breaks. Would you think that that in any way reflects on the intent underlying the legislature's plan?

MR. YEAGER: Objection, calls for speculation and incomplete hypothetical.

You may answer.

THE WITNESS: Okay. In general I'm not an expert on opining that sort of -- that sort of question because obviously I don't have firsthand knowledge of what was on the legislator's mind. I can't really go further than to give you the general statistical conclusions that I've given you obviously in my report here.

I would probably -- at the very least I would need a lot more information.

I think you posed it as compared to the other

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alternative plans that the legislature was considering, the enacted plan had the fewest number of county breaks, and obviously that's a big unknown there. What were the alternative plans? Was there just one alternative or were there a hundred? And were those alternative plans drawn with an effort towards minimizing the number of county breaks?

At a very minimum I'd need to know some answers to those sorts of questions before I could really --

BY MR. CARVIN:

Q. So you're really not opining on the partisan intent behind these plans because you haven't examined these relevant issues, right?

A. Well that's not what I just said.

I am opining about the partisanship of the enacted plan; but the basis, as I've said, the basis of my opining on it is simply comparing it to these computer-simulated plans. Obviously I've not gotten into the heads of the legislators, figured out what they were considering or any alternatives they were considering.

Q. So you're not opining on their intent, you're simply opining on the results as compared to your simulated plans, right?

A. Well if you mean intent as in have firsthand knowledge of what was in their minds, certainly I'm not.

I am opining to their partisan intent insofar as I'm able to say this is the sort of enacted plan -- this

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enacted plan is the sort of plan that has a partisanship that could not be explained or could not have reasonably been expected to emerge from this sort of simulated districting process that prioritizes these things.

That's the basis of me saying it seems like there was some kind of partisanship here.

Q. Right.

A. So I mean whether you want to call that partisan intent or not --

Q. That's your phrase.

A. Sure. I mean I call it partisan intent because I'm comparing --

Q. Right.

A. -- the sort of enacted plan that emerges from another process that I am designing to be ignorant of partisanship.

Q. Right.

A. So I call it partisan intent.

I sort of understand that you're sort of meaning something a little bit different when you're asking me about legislators considering alternative plans. And to the extent that that's a different concept, obviously I'm telling you that I have no firsthand knowledge of anything the legislature -- the legislature was considering.

Q. And your algorithm in all these plans were developed, what, six, seven years after they had already voted on the plan,

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right?

A. I'm not sure it was totally six years, but something in that rough -- obviously several years. I get your point.

Q. Let me ask you a hypothetical. In an employment context, the employer hires a white person. Five years later, a clearly objectively better-qualified black person applies for the job. Would you infer that the failure to select the objectively better-qualified black person reflects racial intent?

A. I mean obviously it's just going to be beyond my expertise to tell you anything about racial intent in employment.

I understand your general point which is that that second candidate was not available at the time of the original hiring, I get where you're going.

But obviously I'm going to have to answer that it's beyond my expertise to tell you anything about racial intent and employment.

Q. Okay. So as far as you know your entire analysis of partisan intent is directly analogous to somebody arguing racial intent based on not selecting a better-qualified black applicant who applied five years after the decision was made?

MR. YEAGER: Objection, misstates the testimony.

You may answer.

BY MR. CARVIN:

Q. You're not trying to distinguish my hypothetical from the

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analysis used in your report, right?

MR. YEAGER: Same objection.

You may answer.

THE WITNESS: I'm not agreeing with that at all, obviously. I simply said that I understand what you're trying to say with that analogy.

I certainly didn't opine at all, and I'm not -- I'm not opining that I think your analogy is completely the same or really --

BY MR. CARVIN:

Q. Well you are.

MR. YEAGER: Let him finish.

BY MR. CARVIN:

Q. Okay.

A. All I really meant to say was that obviously I'm not agreeing with your statement that those two are perfectly analogous.

Q. Let me make it more general. You are opining on the partisan intent of the enacted plan; when you're analyzing intent, partisan, racial or any others, the only relevant comparison is between the alternatives available to the decisionmaker at the time, right?

A. No. I mean obviously that's not the way I'm analyzing partisanship here.

Q. I know. Can you give me an example of where you're trying to discern intent, you use an example that was not available to

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the decisionmaker to infer a negative intent? We always analyze it in terms of the alternatives reasonably available to the decisionmaker at the time the decision was made, don't we?

A. I'm not qualified to answer that question.

Q. Okay. So if that is true, then whatever evidence is produced by your plans that were created five years later, doesn't shed any light on intent, correct?

MR. YEAGER: Objection, incomplete hypothetical, misstates the record.

You can answer.

THE WITNESS: I'm obviously not agreeing with that.

BY MR. CARVIN:

Q. But you're not disagreeing, are you?

A. Well my answer to your previous question was that I'm just not qualified to give you an analogy in another context outside of my academic work, or my academic expertise here with how I evaluate enacted and simulated districting plans.

You asked me if I could give you an analogy, I said I'm not qualified to do that. But I'm not really concluding or giving an opinion drawing from that in any other way.

Q. Your methodology in creating these simulated plans, is this something you -- well how would you characterize the methodology, I guess? What are you trying to accomplish here? Is there any commercial or other analogs to what

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you're doing?

A. Are there commercial analogs to redistricting algorithms? That was the question, right?

Q. Yes.

A. There is nothing quite literally the same, but the general principle of drawing geographic boundaries using a computer algorithm is certainly, I think, pretty widespread. It's commonly used in the commercial world.

I could probably give you a couple of very rough examples off the top of my head if you'd like.

Q. Sure.

A. I'll give some very general examples.

Imagine if you are Fed Ex and you want to develop -- or UPS, really any shipping company, and you want to develop delivery zones. You deliver packages in, say, New York City. And obviously you're not going to have just one driver working for you in New York City, you're going to have hundreds of drivers. You have to develop delivery zones. You have to draw, in other words, maps that optimize on something.

Now obviously those optimization criteria are not the sort of redistricting criteria that we've been talking about here today. Those optimization criteria are probably something like what sort of delivery zones would allocate drivers in the most efficient way so that each of the hundred

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drivers employed by Fed Ex in New York City has roughly the same number of packages to deliver, roughly the same miles that they have to drive, something like that.

I mean obviously I'm not characterizing it exactly in a precise way, but you get the idea.

So Fed Ex has to draw delivery zone maps. How do they do that? They wouldn't just have a human go in and draw what looks to be a good idea. They actually really, really try to optimize those maps to try to save on things like fuel efficiency, reduce the number of say left-hand turns that drivers have to make throughout the day, all kinds of logistical things. Make it so that the driver can park safely while they're delivering packages, that sort of considerations.

And what a programmer in that kind of context is trying to do is optimize a map by building in criteria. There is probably not one perfect map, but certainly with those criteria, some maps are definitely better than others at achieving those criteria.

So that's the general idea. I mean that's just one random example of an industry application that's probably pretty widely used.

Q. Outside of your algorithms for redistricting, have you ever taught or written about this optimization method?

A. Have I ever taught or written about it? Sure. I write about

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it quite a bit in my academic work.

Q. Outside of the redistricting context?

A. Well my academic work is outside of the redistricting context. The point is --

Q. I know you wrote three articles that talk about the kind of analysis --

A. Or you're asking --

Q. I'm saying more generally in terms -- go ahead.

A. I think you're trying to ask if I use algorithms that optimize something, but not redistricting.

Q. Right.

A. Not redistricting criteria.

No. I mean it's my academic -- it's really one of my core academic areas. I specialize in writing about legislative districting, political geography. So this is basically what I focus on.

Q. But the optimization method itself is not something in, anything that you've taught or opined on the correct way to create samples, create random sort of samples?

A. That is what I write about in my redistricting papers. And I think you're asking do I do any of that same sort of stuff in any area of study outside of redistricting. I think that was your question.

And again, the answer is no. I primarily write -- these days I primarily write about legislative districts and

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about political geography.
Q. And you've never been hired as a consultant outside of this context on optimization methods more generally?
A. On optimization methods?
Q. The kind of thing you described with the Fed Ex, for example.
A. Oh, yeah, I'm not a consultant for Fed Ex or any entity like that.
Q. Okay.
A. If I were, I probably couldn't have given you that example.
Q. Right. So you've presented a number of analyses in your report here of districts, particularly in the past elections, right? The 2006 through 2010 statewide elections, and the 2012 through 2016 elections.
My question is are you doing any analysis or making any forecasts about results that will reasonably occur in 2018 or 2020 relative to the three offices at issue in this case?
A. I did not make any forecasts regarding specifically what I expect to happen in 2018 or 2020, beyond generally just analyzing the enacted districts.
Q. Right. But you're not making any predictions in terms of the number of Republican congressman, Republican state legislators that are going to be elected in 2018?
A. Not beyond just generally analyzing the partisan of the districts. So I think I'm generally not trying to say, for

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example, that somehow I think that in November 2018, the Republican party will win three more House seats than it has in the previous election, nothing like that where I'm making a new prediction relative to past partisan performance, nothing specific to 2018.
Q. But even generally, you're not making any prediction about whether or not Democrats will achieve at least proportional representation in the Congressional delegation, Senate delegation and House delegation in 2018 or 2020, right?
A. Okay. That's a little bit of a different question. I definitely am not analyzing whether either party will achieve proportional representation in any election really.
Q. All right. And you're not making any predictions about whether Democrats will achieve any level of representation in the 2018 or 2020 elections with respect to the three offices at issue?
A. Again, only insofar as I've generally analyzed and reported on the partisanship of the enacted districting plans.
Q. Right.
A. So I've generally characterized the partisanship of those plans and obviously that is a characterization that could apply in an election like 2018 or 2020. But it's not a characterization that is specific to 2018, as opposed to 2016, as opposed to 2014.
Q. Well all your other things are backward looking, all the

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analyses are of the elections that have already occurred. My question is are you inferring from what has occurred in the past any predictions or statements to a reasonable degree of professional certainty about what will occur in the 2018 elections under these redistricting plans?
MR. YEAGER: Asked and answered.
You may answer.
THE WITNESS: Like I said, all I'm doing is characterizing the general partisan performance of those districts. That characterization is generally going to be valid as -- if the districting plan continues to be in place.
BY MR. CARVIN:
Q. So you are -- what do you mean by likely to be valid? You're saying that the numbers produced in 2018 will be very similar to, identical to the numbers in your report?
MR. YEAGER: Asked and answered.
You may answer.
THE WITNESS: No. I certainly am not predicting that because -- I'll just throw out a random example. I calculated that in the enacted Congressional plan, using recent past statewide election results, you can see that nine districts favor Republicans and five favor Democrats. It's not saying that I'm specifically guarantying or predicting that there will be exactly nine districts going for Republicans in 2018.

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It's a general characterization of the partisanship of that districting plan which, if that districting plan is still in place in November 2018, then it's still an accurate characterization of that districting plan for the purpose of 2018, as it was for 2016, as it was for all earlier years.
It's just a characterization. I'm not saying, for example, that I think there is going to be a two percent Republican tide in 2018 relative to 2016. That would be I think what an election specific prediction does.
BY MR. CARVIN:
Q. I don't want to focus on the word specific. Are you opining on the likelihood of electing seven Democrats in the Congressional delegation in 2018 based on all the numbers in your report?
A. Only insofar as in general, what I am opining on is that, for example, the enacted Congressional plan is a nine-five plan, meaning that what my opinion is is that the long-run average is going to be, over any number of elections, is going to be that an expectation that the Republicans will win nine districts out of 14 in the Congressional plan.
Now I'm not characterizing that as a 2018 specific prediction, but obviously you can see how that prediction could cover the 2018 election year. I just want to make that distinction.
Q. I'll ask you again. What percentage likelihood is there of

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electing seven Democrats in 2018 or 2020 based on your analysis in this report? Are you opining on that?

MR. YEAGER: Asked and answered.

You can answer.

THE WITNESS: I'm not arriving at a prediction to say there is X percent probability that the Republicans will win seven, Y percent probability that the Republicans will win eight, nothing like that.

As I said, I'm characterizing the partisanship which I take to mean -- to say that in the long-run expectations Republicans are going to win in the enacted Congressional plan nine seats and Democrats will win five.

BY MR. CARVIN:

Q. The long-run expectation in this case is the 2020 elections, you understand that, right?

A. Well I'm trying to analyze really all elections for a number of years.

And I understand that some of those are in the past, and I appreciate your making this distinction that we only have 2018 and 2020 ahead of us.

Q. Okay. But you don't think that this litigation is going to affect the 2018 elections, do you?

A. That's completely outside of my expertise.

Q. Do you have a calendar? You don't really --

A. All right. I'll grant you that we're pretty darn close to

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November. I'll go out of my way to agree with you on that.

Q. All right. So all we're talking about 2020, that's the only significance here.

I'll ask you again, do you have any general analysis of the likelihood of electing seven Democrats under the enacted plan in 2020?

A. Same answer as before. What my numbers are saying is that in general we expect the enacted Congressional plan, as an example, to be a nine-five plan. That's a general expectation, and sure, you can apply it to the 2020. And that's how I intend for it to be used.

Obviously, as I said before, I'm not specifically giving you a predicted probability that the Republicans would win seven as opposed to six as opposed to eight, nothing like that.

Q. And you're not going to give me a predicted probability that Republicans are going to win nine, right?

A. I'm not giving you a predicted probability. All I'm telling you is that in general there are nine Republican districts.

Q. As you defined it. Okay.

Let me ask you about how you do define them. If you could turn to page 52 of your report, please?

A. Okay.

Q. And essentially what you're describing on these pages is you analyzed the durability of the enacted plan's partisan

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results through a uniform swing analysis. Do I have that straight?

A. Yes.

Q. And your uniform swing analysis was based on actual Congressional elections or House elections or Senate elections that occurred in the last six years, right?

A. In '12, '14 and '16, yes, so I guess that's -- well I get what you're saying.

Q. You didn't base your uniform swing analysis on the numbers produced by your collection of statewide races from 2006 to 2010 and 2012 to 2016, right? You based it on the real world endogenous elections?

A. I did not apply uniform swing to the statewide election measure.

Q. Right. You applied it to real world endogenous elections, right?

A. I'll just state the real world legislative elections. I'm not going to guess what you mean by the term endogenous, but I think we're obviously, we're talking about the actual legislative elections that actually occurred in '12, '14 and '16.

Q. Okay. Just to be clear and maybe save some time, when I say endogenous I mean elections for the office at issue as opposed to exogenous elections for governor, etcetera.

A. Sure, I got you.

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Q. All right. And why did you do that?

A. Why did I analyze the uniform swing here with respect to the so-called endogenous elections?

Q. Right.

A. Well I wanted to analyze the partisan durability of the various enacted plans that I was analyzing.

Q. But when you were comparing the partisan results of the enacted plan through 2016, you didn't use the real world endogenous election results, you used this collection of statewide races from 2006 -- 2012 through 2016?

A. Correct. And obviously '06 to 2010 as well.

Q. Right. Why would you use a different set of elections to analyze the durability of a partisan gerrymander going forward, than from whether, analyzing whether or not it was a partisan gerrymander through 2016?

A. Well it's two different questions. So I'll speak to the durability here and I'm happy to go back to the simulation analysis.

But it's two different questions here. What we're asking when I'm trying to analyze partisan durability is to say, let's suppose you applied a shock, an exogenous shock. What sort of swing would it take to, say for example, flip around the partisan control or even out the partisan control.

It's just a completely different kind of question based on actual partisan elections here in the recent past.

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I'm not -- with what I'm doing here, I'm not just trying to characterize -- characterize, say, the enacted plans in terms of their overall partisanship so that I can directly compare it to the simulated plans. When I'm looking at durability here I'm not doing a direct comparison to the simulated plans.

So we don't need to get out of the, out of the realm of the individual districts and come up with a measure of partisanship that can apply to alternative districts. That's off the table here.

What I'm doing with durability is nothing but looking at the actual districting plans. So I'm able to use the so-called endogenous elections because I don't have this sort of issue of trying to come up with an apples-to-apples comparison to simulated districting plans.

Q. Right.

A. So it's just two completely different sorts of analyses.

Q. But if you were, wholly apart from the simulated plans, trying to assess the partisan results of the enacted plan, you would use endogenous elections. The reason you're using exogenous elections is because you need to compare the plan to these thousand simulated plans. Do I have that right?

A. I will agree to qualify that's one of the reasons. There are other reasons as well, but that is certainly one of the reasons.

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Q. Okay. If you were just trying to figure out the partisan effect of a redistricting plan, which is better, endogenous or exogenous elections?

THE WITNESS: If I could ask you to read that back.

(Record read: Q. If you were just trying to figure out the partisan effect of a redistricting plan, which is better, endogenous or exogenous elections?)

THE WITNESS: The answer is it will depend on what you mean by partisan effect.

What I'm trying to answer, which obviously I do in my report, is what is the partisan difference --

BY MR. CARVIN:

Q. Right.

A. -- between an enacted plan --

Q. I apologize for interrupting, I really do, but I want to clarify my prior question.

A. Okay.

Q. You're making a very helpful distinction between the partisan difference between an enacted plan and the simulated plans.

Now I'm asking you to say you're not examining that question, the partisan differences, you're just simply trying to figure out the partisan effect of the enacted plan in and of itself.

In that circumstance, endogenous elections are more probative than exogenous elections, is that right?

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A. No, I wouldn't necessarily say so. Again, it's going to be context dependent. And there are some various reasons for that and I'm happy to start listing out some of those reasons.

But as a general principle, there is no one election that is always going to be the perfect measure. And in general the reason I use statewide elections when I'm measuring the partisanship of enacted plans and along with the simulated plans, is because using more elections is more helpful, more stable and gives us a more accurate indicator of the long-run partisanship of a district.

Q. What about -- I'm sorry.

A. But to get back to using the endogenous elections, it could be. But it might not be. It's really context dependent.

It could be that the endogenous elections are really skewed by, say, biases that were present because of the incumbents that were already in place elected from the previous decade's plans. Those things could skew the mere use of endogenous elections in evaluating the current decade's plan.

The point is just that nothing is perfect, and it's context dependent.

Q. What is a better predictor of the results -- the results in the Congressional elections of 2018 and 2020, the results in the Congressional races for 2012 through 2016, or exogenous

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elections for other offices during that time period?

A. Which is better for the purpose of predicting 2018 to 2020 results? It really depends. It could be the case that endogenous elections are a more accurate predictor, but that's not necessarily the case.

It's context dependent because using endogenous elections brings in inevitably a large number of factors that are not necessarily always going to be present in those same districts.

So if there are drastic shifts in say a partisan tide that was present in 2016 that's not present in 2018, that could affect things. If there were campaign finance differences, if there were incumbency differences, all those factors could mean that using statewide elections is actually a better predictor.

Q. Have you ever written an article on what is a better predictor for the last -- for future elections, the results in prior endogenous elections in the same districts or exogenous results?

A. Let me make sure I understand the question. Have I ever written an article in which I'm specifically comparing statewide elections versus endogenous elections?

Q. Sure.

A. That's the question?

Q. Yes.

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A. Let me think. I can't recall an article where that was the specific focus of the article was to compare these two methods and to say one is better in these cases or the other is better.

Q. Can you cite me an article that contends that exogenous elections are better predictors of future results in those offices than exogenous elections?

A. Can I cite any academic article that has tried to show using exogenous elections is superior?

Q. Yes.

A. I'm going to try off the top of my head. I'm generally aware that that's been the subject of some study in the literature, and there is a paper by Simon Jackman, and I believe two co-authors that gets at that question. And they settle upon using some kind of statewide election. I believe they settle upon using something like a presidential election based method of predicting Congressional election outcomes.

And I think it's limited to just Congressional, not state legislative predictions.

It was Jackman and two other authors, I can't remember off the top of my head right now. I think one of them was Josh Clinton, but I'm kind of blanking on who the last one was.

So I'm generally aware of that kind of literature.

Q. Okay. If you could turn to page six of your report?

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A. What page?

Q. Six. I'd like to direct your attention to the first -- second full sentence. You say, statewide elections are thus a better basis for comparison than the results of legislative elections such as U.S. House and state legislative elections, because the particular outcome of any legislative election may deviate from the long-term partisan voting trends of the constituency, due to factors idiosyncratic to the legislative district as currently constructed. Right?

So you think that the outcome of legislative elections at issue in this litigation may deviate from the long-term partisan voting trends that are reflected in the statewide elections, correct?

A. Like I said earlier, that's always a factor. Or there are always many such factors when we're looking at legislative election races.

And just as a very general principle, like I'm stating here, when we look at a large number of statewide elections, and very often there is more than one statewide election in a particular election year, we get greater stability in our understanding of the partisanship of a particular district.

Q. Right. And you list legislative specific factors that affect outcomes in the real world, right? The presence or absence of a quality challenger, anomalous differences between the

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candidates and campaign efforts, or campaign finances, and incumbency advantage. Those are the kinds of factors that affect election outcomes in the real world, right?

A. Yes, that's what I said here.

Q. And your analysis of the statewide election doesn't pay any attention to those real world factors that affect elections in the real world, right?

A. No. That's not true at all. Obviously these factors, at least some of these factors, are present in any set of statewide election results, or at least they can be present.

Q. All right. Let's take them one at a time. You're saying that incumbency advantage is factored into the results for the university and board of trustees in the districts you're analyzing?

A. I'm not specifically saying that about the university board elections.

Q. All right. Any of the statewide elections don't factor in the House, Senate or Congressional incumbent in their election results?

A. Oh, okay, I get what you're going. You're going to something a little bit different than what I was thinking about.

So all I really meant with my previous statement there was that as a very obvious matter, in a race for the U.S. Senate or the state governor, the incumbency of the current officeholder of that office, obviously can be a

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factor. And I'm just admitting that, sure, some of these factors are present too in statewide elections.

I obviously didn't mean to imply that what you were kind of getting at which is that somehow the State Senator being an incumbent from State Senate -- State Senate District number five would affect the Michigan gubernatorial race, or how much it would affect.

Obviously what I'm talking about is the incumbency of the officeholder in those statewide elections.

Q. Right.

A. And obviously I'm saying that things like campaign finance can certainly affect statewide elections.

Q. Yes, I know. But when you're analyzing legislative elections on the basis of statewide elections, you will not look at either the incumbent in the district, how well financed he is or the quality of his challenger, none of that will be factored in? All of those factors will be factored in if you looked at prior elections for the office in the real world district, right?

A. And just to clarify, you're now going back to my statewide measure analysis of the enacted and the simulated plans --

Q. Correct.

A. -- when you're asking that. Okay. I get where you're going now. Obviously I acknowledge that's true.

All I'm doing here is adding up the number of

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Republican and Democratic votes in those statewide elections. I'm not, say, adding a two point boost for a really good campaign fundraiser or something like that.

Q. Nor are you looking at the elections in those districts which included factors such as incumbency, campaign finance and the like?

A. I simply just measured the partisanship with respect to those statewide elections.

Q. Okay. In North Carolina, in addition to the analysis based on statewide races, you analyzed the simulated plans based on vote shares generated by a regression model that controlled for incumbency and turnout, did you not?

A. Yes, that's correct.

Q. And incumbency and turnout will effect elections in the real world?

A. Well I can characterize my findings in North Carolina, which was that obviously I produced a regression model --

Q. I'm not asking about that.

A. Okay.

Q. I'm asking, does incumbency affect elections in the real world?

A. Okay. You're just asking as a very general question.

Q. Yes.

A. And my answer is in general we know it does, obviously there is variation in when it does. But in general.

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Q. And turnout affects elections in the real world?

A. Does incumbency affect turnout?

Q. No, does turnout affect election results?

A. Oh, sure. I mean obviously the relative turn out of Democrats and Republicans in any particular election is obviously going to have influence on who wins.

Q. And you didn't do any similar analysis in this case like you did in North Carolina, is that true?

A. Oh, that's not true at all. I mean if you'd like to ask me about something specific --

Q. Maybe I misunderstood. You did --

A. I think you were trying to ask specifically about the regression model.

Q. Yes, did you do a regression model like the one I described in North Carolina in this case?

A. I got you. And the answer to that question is here I did not do that sort of regression model, I just counted on the statewide election votes.

Q. Okay. And then if you turn to page ten of your report? Well, you breakdown these components into 2012 -- 2002 to 2016, and 2006 to 2010, right? You present them both ways?

A. 2006 to 2010 then '12 to '16.

Q. Yes. And which is more probative of those two, if either?

A. That's not a question that I directly tried to pit one against the other, and tried to adjudicate between the two.

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In general they're both indicative of the underlying partisanship of the districts.

Q. But you haven't made any analysis or determination as to which of the two sets is more probative of the partisan constituency of the plan?

A. No. Other than to generally see that they are both pretty highly correlated with the overall partisan performance of the districts during this decade.

I didn't, say, calculate whether one produced a slightly higher correlation than the other, other than to generally figure out that they were in fact -- they seemed to be strongly correlated.

Q. Okay. You say that using recent past statewide elections has been an extremely accurate predictor of actual legislative outcomes in the enacted plan. Correct?

A. Maybe you could just help orient me.

Q. I'm sorry, the second paragraph. I find that overall, using past statewide elections has been an extremely accurate predictor of actual legislative election outcomes in the enacted plan's districts?

A. Yes, I see that sentence.

Q. Okay. And then you go on and you say that it's been accurate in Congress because the statewide elections predict nine Republican seats, and that's what happened in the real world. Right?

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So you got the number -- the statewide elections predict the number of Republican seats in the Congressional elections, right?

MR. YEAGER: Objection, incompletely states the document.

You may answer.

THE WITNESS: What I'm reporting here is that there are nine districts that, using the statewide elections, are favoring Republicans over Democrats in both the 2006 and 2010, as well as the '12 to '16 statewide elections. And I can see that obviously those nine districts are the same ones that have been electing Republicans.

BY MR. CARVIN:

Q. And you would count a Republican district as anything that's a 50.1 percent district under the statewide, correct?

A. That's correct. I'm simply characterizing them as having more Republican votes or more Democratic votes as a share of the total summed up aggregated two-party votes across all those statewide elections.

Q. So you would equate a 51 percent Republican district as a Republican district, as well as a 65 percent Republican district?

A. I wasn't really equating them other than saying I'm characterizing them as Republicans.

Q. Right.

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A. So I guess you could say they were given characterizations that were the same.

Q. What I'm trying to figure out is did you ever look at how close the real world percentages were to the statewide percentages in the individual districts?

A. Okay. I see, you're asking if I ever took the difference between the results in the endogenous election, and the aggregated partisan vote share in the exogenous statewide elections.

To my recollection, I can't specifically remember doing that here in this report. I certainly don't recall reporting such numbers here in this report.

It's something I've generally studied as a political scientist in my academic work.

Q. But you didn't do it here?

A. I don't recall specifically reporting it here.

Q. It's not in your report?

A. I don't recall it being in my report.

Q. Okay. And even with respect to whether or not the same results occur in terms of whether a seat is Republican or Democratic, with respect to the House, if you'll go to the last paragraph, you predict in your amalgam of races that the State House elections would be 61 Republicans, right?

A. I'm basically just counting up and reporting that, yeah, it's 61 districts that have more Republican than Democratic votes during the '6 to '10 and the '12 to '16 elections.

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Q. And that's under both the 2006 to 2010 elections and the 2012 to 2016 elections, right?

A. I see that right there, yes.

Q. And in the real world there has never been 61 Republicans in the House in 2012, 2014 and 2016?

A. I can see here in the next sentence that it's basically right around 61, it's 59, 63 and 63. In other words all clustered right around 61.

Q. Right.

A. Obviously never exactly 61, not one more or one less.

Q. And every year you were off by at least two seats when you compared the statewide election results that you came up with and the real world elections for the House, right?

A. Yeah. I guess you could say 59 is two below and then 63 is two above.

Q. And you consider that an extremely accurate predictor, being within two House seats? You think that's an extremely accurate predictor?

A. Well in general when we're predicting, say, state legislative districts, from my experience having used similar sorts of statewide elections in other states to predict legislative elections, this sort of accuracy is about what we expect.

I mean obviously the point is that not every single -- we would never expect -- it would be shocking to see if over the course of a decade every single State House race produced exactly 61 or 55 districts favoring Republicans with never a deviation. One would start to probably question the legitimacy of election results if they were that predictable.

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But the point is that we expect in general to have around 61 out of 110 districts favoring Republicans. And from the '12, '14 and '16 results that's basically what we see. They're all clustered right around 61 out of 110.

Q. So you don't expect -- or you do expect to be off by say two seats based on your statewide analysis in terms of predicting election results?

A. I wouldn't say it's in general we expect to be wrong by exactly two seats.

Q. In other words, it wouldn't surprise you?

A. Well, it depends. In general we obviously know that statewide legislative election results ebb and flow along with whatever partisan tides are going on at the time.

So if in 2016 the Republicans have an especially good year, we expect that number to be a little bit above 61. In 2012 when you've got President Obama on the ballots and the Democrats have a relatively good year, we expect that number to be a little bit below 61. In an even year you might expect it to be closer to the expectation.

But the point is that we expect there to be some kind of fluctuation naturally because obviously partisan tides, and obviously other idiosyncratic factors are something that's a constant in these sort of elections.

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Q. What would you expect in 2018 in the Congressional elections?

A. Oh, I'm not the sort of forecaster --

Q. But you're a political scientist --

A. But I'm not --

MR. YEAGER: Wait, wait. We're going to have questions, and we're going to have answers.

Professor, let's wait until he asks a question.

Please ask a question.

THE WITNESS: I get --

MR. YEAGER: Wait until he asks a question.

THE WITNESS: Okay.

MR. YEAGER: Is there a question on the table?

BY MR. CARVIN:

Q. Historically how does the president's party do in the following off-year elections in Congress, better or worse than prior elections?

A. If I could ask, in the following off-year?

Q. Yes.

A. Oh, in the second year of the president's term?

Q. Yes.

A. I'm going to start by qualifying this is not the sort of thing I study. I don't study political election history, I

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don't study historical election results.

It is sometimes certainly the case that the president, that the president's party doesn't do as well in the second term -- I'm sorry, in the second year of the president's first term. But that's not always an absolute. That's a very, very general pattern with lots of exceptions.

And more broadly the point is that I'm not an expert in election forecasting. I'm not the sort of political scientist who tells you that I think that Trump's approval rating is going to translate to a particular performance by Republican or Democratic candidates this November. That's just not the sort of expertise I have or do.

Q. You're not an expert in what will happen in upcoming elections?

A. Well again that's not quite accurate. The point is that election forecasters make specific predictions about specific upcoming elections using things like polling data, surveys.

I'm able to still characterize the general partisanship of a district or a state jurisdiction, and say over the long term here is what we expect the partisan performance of that district to be.

But I'm not the sort of election forecaster who is able to look at a bunch of polls and somehow define these poll numbers are going to translate into really good news for

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the Republicans or something like that.

Q. So you're not even an expert in making general predictions about the composition of the Congressional or State Senate or State House delegations?

MR. YEAGER: Objection, asked and answered. Misstates the testimony.

You may answer.

THE WITNESS: Okay. That's not what I said, and that is not what I said earlier.

BY MR. CARVIN:

Q. Well if you can't forecast specific cases, how in the world can you forecast the general composition of the delegation?

MR. YEAGER: Hold on. You interrupted the last answer, do you want to withdraw that question? Or do you want him to answer the rest of the question, the prior question?

MR. CARVIN: Go ahead and answer the question.

MR. YEAGER: The prior question?

MR. CARVIN: Whatever will get us through this quicker.

After you filibuster, please answer the question.

MR. YEAGER: Let's stop and take a break.

(At 3:32 p.m. went off the record.)

(At 3:41 p.m. went on the record.)

MR. CARVIN: Back on the record.

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BY MR. CARVIN:

Q. Again, I think we left off when we were at page ten of your report.

A. Okay.

Q. And under both your 2006 to 2010 and your 2012 to 2016 statewide elections, you assessed that there would be 24 of the 38 districts would have more Republican votes, correct?

A. I see that there, yep.

Q. And then in the real world, the Republicans won 27 seats?

A. Correct.

Q. So again, your analysis based on the statewide elections was off by three votes in a, what, 38-seat body, right?

A. From the math there, that's the difference between 27 and 24.

Q. Right. Three seats is a lot in a 38-seat body, isn't it?

A. It really depends on the context. And the point is not that if you have one election, that you will somehow predict there to be exactly the number of Republican victories as what the statewide elections would have favored. That's not the point at all.

As I said, when we construct, say, a partisan measure using a long range of statewide elections, it's a long-run expectation. You expect that over several elections, some will inevitably be a Republican tide, some will inevitably be a Democratic tide, and some will be more even. But over the long run in expectation there are 24

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districts that are -- 24 districts is what's most likely to emerge in expectation.

That's not making a specific prediction that I know with some degree of certainty that it will be exactly 24 in any particular election.

So in other words it doesn't surprise me at all that you can have one election and the deviation from the number 24 could be three. That's really just to be expected.

Q. So it wouldn't surprise you at all in one Senate election if your predictions based on the statewide analyses was off by three seats, right?

A. I think that's just what I said is that it's really not at all surprising to see that you have election results that, over several elections, cluster around the predicted number which in this case is 24.

So clustered around means that there is inevitably going to be some deviation.

Q. Hum-hum. And that deviation might well occur in 2018 or 2020 as far as you know?

A. Yeah. The same caveats, that I'm not making any specific prediction about 2018.

Obviously there is no such thing as saying we can take this statewide measure and say with accurate certainty that the Republicans will win exactly 24 and no more or no less. That's not the point of measuring the partisanship

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using statewide elections like this.
Q. You used efficiency gap and mean-median differences, at least a robustness check on your partisan skew analysis, right?
A. I used them to look at the partisanship of the districting plans. They are generally robustness checks.
Q. I thought that's how you characterized them.
A. I'm affirming that they are robustness checks.
Q. Okay. Is there a generally accepted viewed in the political science community about what efficiency gap scores constitutes an extreme or unacceptable partisan bias?
A. I'm not going to characterize -- I'm not sure I'm in a position to characterize the entire literature in the entire political scientist field.
Obviously I'm aware that some people have opined about what constitutes an extreme efficiency gap. It's not something that I take a particular opinion on. Obviously I'm aware that some others have, and I'm clarifying that I am not taking an opinion.
Q. So it's not a consensus or well-accepted view, it's individual opinions about this?
A. I'm not sure I surveyed the field enough to say for sure whether there is something approaching a consensus. I'm just not really in a position to do that kind of survey and tell you what the field thinks.
Like I said, some people think there is some

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particular threshold that that person thinks is extreme. I'm not sure if that's the exact characterization that some people would use and obviously others don't. I'm acknowledging there is a diversity of opinion.
Q. Can you give me an example?
A. Can I give an example?
Q. Of a number that somebody thinks --
A. Oh, of a number? I don't want to make something up off the top of my head. I'm generally aware that some scholars have cited an actual percentage. And I can't accurately attribute to somebody a precise percentage off the top of my head. But I'm aware that's been done in different forms.
Q. I can ask you the say questions for the mean-median difference, and I will. Is there any consensus or well-accepted view about what constitutes an unacceptable or extreme mean-median difference score?
A. Not that I'm aware of. I think there are recognized methods of -- there are recognized methods of arriving at a way to quantify what might be an extreme mean-median, just as certainly there have been approaches used to try to quantify what sort of efficiency gap one might expect in a particular state.
I think sometimes those can be context or geography dependent. But I'm not aware of any, say, broad consensus that a mean-median gap over X percent is somehow, some sort

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of an outlier or red flag automatically by virtue of being above X percent.
Q. I can give you examples, but in your report you use the words Democratic districts have been packed and cracked. And I'm just trying to get your definition of those terms. What's your definition of a packed district?
A. So because you're talking about when I use those terms at the end of my report, right?
Q. Certainly at the end, but I think there was a couple of occasions before that. But regardless --
A. Okay.
Q. -- what's your definition --
A. Of packing and cracking, okay.
I'll give you my best shot. I'll qualify in general that by saying that as a political scientist I don't understand those terms to mean anything precise in any academic sense. Meaning that there is no standard or set political science definition of how do you quantify what rises to the level of clear cracking or packing. There is just not an objective scientific definition of that.
And so when I use the term cracking and packing, those are terms that are really just borrowed from what people use colloquially, from what the popular press uses, from what journalists use. Obviously journalists use those terms.

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And I generally understand what the popular media means when it uses those terms. Again, I don't have a precise academic objective definition of crack and packing. But I tried to operationalize that in the context of my analysis here by taking what I understand others to mean by those terms, by the terms crack and packing.
So I'll give you now my best shot at explaining how I operationalized and defined those terms here in my report. So I just wanted to make all those qualifications first.
What I call a -- we will just start with packing. What I operationalize a packed district to be, and again this is just my best shot at trying to put an operation to what others mean by the term, is to say if there is a district that is a certain percentage Democratic vote share, just as an example, and it's an enacted district, and it has a certain percentage Democratic vote share, and then I go look at alternative computer-simulated districting plans, and look at the same district in that same geographic area, as the enacted district, and I look at several simulated districts in that same geographic area, and I look at the partisan vote share, the Democratic vote share of those alternative computer-simulated districts, and I see that the vast majority of those alternative computer-simulated districts in that same geographic area are less Democratic leaning, have a lower Democratic vote share, in other words, a higher

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Republican vote share, than that enacted district, that I just for shorthand call packed.

Again, not a scientific term in any way, just trying to operationalize it.

Q. I'm confused. You're saying that if the alternative plans have a lower Democratic percentage, then anything above that percentage is packed?

A. No. I got it backwards. And I apologize if I misspoke and mislead you there. I'll put some actual numbers to try to make this clearer.

So let's suppose that the enacted district number one, hypothetical district, has a 70 percent Democratic vote share. And then we look at the computer-simulated districts in that same geographic area, covering the same geographic area, and they all have lower than a 70 percent Democratic vote share, that I just label packing.

Q. All right. Let's assume district one has got a 53 percent Democratic vote share, and all the alternatives are at 52. Are you arguing that the 53 percent is a packed district?

A. If it's one thousand out of one thousand, I'm applying that same shorthand label packing. It's just a purely mathematical operationalization.

Q. So any time an enacted plan in this case has a higher Democratic percentage than the simulated plans, it's a packed district?

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A. Than virtually all the simulated districts in that same geographic area, I'm labeling that packing.

Q. And that's for above 50 percent.

For below 50 percent, is the district cracked when the enacted plan has a lower Democratic percentage than the simulated plans?

A. Let me -- if I could, let me just review my report and I want to make sure I get this absolutely right, so if you could allow me a moment.

Q. Yes.

A. Okay, thank you for that.

Yeah, I think your characterization there was -- basically I'm going to put it in my own terms to make sure I got it right, but I think this is the same thing as what you're saying.

So for cracking, what we're describing here is if there was a district where, and I believe I used 95 percent, if 95 percent of the simulated districts are on the other side, in terms of partisan vote share, then it's characterized as, with the label crack, cracking.

Q. Just to be clear, when you say on the other side, you don't necessarily mean that the seat switches, but are on the other side in terms of the higher Democratic percentage?

A. Correct. I'm not necessarily saying anything about the seat flipping above or over 50 percent. It's purely relative to

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the enacted district comparison.

Q. So you would call any Democratic district cracked at 48 percent if the middle 95 percent was 48.5 or higher?

A. Right. The 50 percent cutoff that I think you're thinking about, that's not relevant here.

Q. No, but can you answer my question?

A. Sure, I apologize. That's right.

I mean you're just looking at whether there are, say, something like 95 percent or more of the simulated districts that are all on one side or the other.

Q. Okay. So you're using packed and cracked in a very specific way that applies only to your simulation analysis. You're not using it in the way that's used in most political science literature, is that what I understand?

A. Well I'm not going to try to characterize how, quote, most political science literature uses it. I don't have the basis for answering that.

I am acknowledging that this is an operationalization of the cracking and packing terms that is specific to my analysis here.

Q. Do you have an understanding of how the term is generally used in political science, packed for example?

A. Well the reason I gave that caveat, that long caveat at the beginning, I'm saying look, I don't understand the terms packing and cracking to mean anything very precise in

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political science literature. I'm obviously aware that other scholars have used it before in academic literature, and I've seen it used in slightly different ways and slightly different contexts. And to my knowledge or at least to the extent of my expertise, there is not a single objective operationalizable, clearly understood in a scientific manner objective definition of exactly what packing and what cracking is.

That's why I gave that very long caveat just to say that what I'm trying to do is just to understand how I think it's popularly used and do my best shot at applying it here.

Q. Do you have a view on what constitutes a competitive district?

A. I don't really have a precise definition. Again same answer there, I'm aware that --

Q. What would you say the most accepted view in the political science literature is?

A. I really couldn't say.

Q. Would you say 45 to 50?

A. I really couldn't say whether that's somehow the most accepted viewed or not. I mean I'm generally aware that people have tried to quantify it, but I really couldn't give any sort of informed, precise answer, other than to say obviously I know in the literature people do try to quantify competitive --

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Q. 40 to 60, would that be a potential definition of competitive?

MR. YEAGER: Asked and answered.

You can answer.

THE WITNESS: Same answer as before. I'm aware that people have tried to operationalize it by saying something like is this a district that is within X to Y percent of a 50/50 line, something like that. I'm generally aware that people have tried that.

I'm just not comfortable saying that there is any sort of real consensus on the one right way to do it.

BY MR. CARVIN:

Q. All right. If you could turn to page 17 in your report, please.

A. Okay.

Q. The top table, and this reflects the 2006 through 2010 statewide elections?

A. Yes. I see that.

Q. And 32 percent of the simulated maps produce an eight Republican, six Democratic plan for Congress?

A. I see that there, yes.

Q. Okay. And let me see. And 77.8 percent produce a plan with at least seven Republicans?

A. I think you're adding up -- sorry, I believe you're adding up 45.3 and you're adding 32 to that, so that's 77.3 percent. I

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agree with your math.

Q. All right. So if the enacted plan had produced an eight-Republican delegation, that would not have been a partisan outlier?

A. I didn't do that analysis. I'm happy to tell you how I would do that analysis in terms of statistical tests. But I'm just clarifying that I did not analyze that hypothetical.

Q. Okay. Okay. But it would be consistent with 32 percent of the plans that were produced without any partisan intent, right?

A. In your hypothetical where the enacted plan is an eight-six plan, right.

Q. Right.

A. Sure. I mean obviously by definition you're saying would that enacted plan have the same number of Republican seats.

Q. And maybe I am misunderstanding your terminology.

Are you saying that if it had, if the enacted plan had predicted an eight Republican seat delegation, you would consider that a partisan outlier based on 2006-2010 statewide elections?

MR. YEAGER: Asked and answered.

You can answer.

THE WITNESS: Yeah, I said that I did not do that analysis.

BY MR. CARVIN:

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Q. Right.

A. I'm happy to -- maybe this isn't responsive to your question, but I would be happy to walk you through and explain statistically how I would analyze such a hypothetical question.

Q. Well I'm just asking in lay terms because it's getting really late and I really don't want to go into extended digression. How can something that conformed to 32 percent of the nonpartisan plans be viewed as a partisan outlier?

A. Well, okay, you're basically asking me how I would analyze it. And I'm happy to explain that.

So as I said some time ago, what I do when I compare the enacted plan to the computer-simulated plans with respect to any of these measures, and earlier we talked about a compactness measure and now we're referring to a partisanship measure, I would do a statistical confidence interval. And that's constructed by something called --

Q. I understand.

A. I won't keep going. I'll stop answering.

Q. Back at the envelope, do you really think this would be outside the 95 percent confidence interval, eight Republican seats? Honestly, do you really think that could happen with 32 percent of the simulated plans coming out --

MR. YEAGER: Incomplete hypothetical, asked and answered, and vague and ambiguous.

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You may answer.

THE WITNESS: My answer is I won't speculate without doing the calculations.

It's not as simple as saying, look, there are 32 plans that are at eight, therefore it couldn't possibly be outside of let's say a 95 percent confidence interval. It's a little bit more involved in the statistical test than just that.

I'm happy to go into that, but I don't think you want me to so I won't for now unless you ask me to.

BY MR. CARVIN:

Q. So let's stay with this.

Do you know what the statewide Democratic vote was for year 2006 to 2010 statewide elections?

A. What the overall Democratic vote share was --

Q. Yes.

A. -- in those elections?

I'm sure I calculated that. I don't recall if I reported it. Obviously I can't remember off the top of my head.

Q. And I'll stipulate to you that Professor Mayer using these said it was 53.2 percent statewide. Does that sound about right?

MR. YEAGER: I'm sorry, Democratic or Republican?

MR. CARVIN: Democratic statewide vote sharing.

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THE WITNESS: Fair enough, and if you wouldn't mind me asking you, 53.2 percent is the Democratic share of the two-party vote or the --

BY MR. CARVIN:

Q. Just two party.

A. So we're throwing out the third party.

Q. Yes.

A. Got it, thank you.

Q. And in those circumstances even with 53.2 percent of the statewide vote, 32 percent of the plans are only giving them six of 14 seats, which comes to 42.9 percent.

A. I'm sorry, where did the 42.9 --

Q. Six out of 14, do you want to do the math?

A. No. Maybe I just need you to repeat what -- your sentence there.

Q. Even though the Democrats had 53 percent of the statewide vote, 32 percent of the purely nonpartisan simulated plans only gave them 42.9 percent of the seats, six of 14.

A. I gotcha. So you're doing six divided by 14.

Q. Correct.

A. I'll take your word for it that the math is right. It sounds roughly right.

Q. Okay. Have you ever heard the phrase, seats-votes curve, or winner's bonus?

A. I have heard of those terms.

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Q. Do you know how that's defined in the political science literature?

A. I'm not right here able to give you a precise definition. I'm happy to give you my best shot.

But, you know, not having just reviewed the various literature on those topics, I'm not sure I can give you a precise definition right now.

Q. In broad strokes, isn't it true that what's characterized, the winner bonuses seats-votes curves you would expect a 53 percent statewide vote to translate into either 56 or 59 percent of the seats, have you ever heard that?

A. It's not quite as precise as saying 56 or 59, and there are a lot of other factors at play.

But I get what you're trying to get at which is the general principle that all else being equal, that if your party has greater than -- a little greater than 50 percent of the two-party vote share, then all else equal, cancelling out all other factors such as things like political geography and other factors that affect districting and legislative elections, campaign finance, all those other things, all else being equal, you're going to get a bit of a bonus in terms of obviously 53 percent of the vote wouldn't necessarily translate into exactly 53 percent of the seat share.

Now it's not as precise as saying 53 percent of votes translates automatically into a 56 to 59 percent seat share. It's never that clean at all because there are obviously lots of other factors such as the underlying political geography of a state, and various other districting criteria.

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Q. None of which you've analyzed in Michigan, right?

A. Actually I have.

Q. So what is the winner's bonus to be expected in Michigan?

A. Okay. I was talking about the criteria that was mentioned. Obviously I've analyzed those.

Q. But you haven't analyzed how they affect the seats-votes curve or the winner's bonus in Michigan?

A. I did not try to quantify say an entire seats-to-votes curve insofar as trying to say if the Republicans were to hypothetically win 65 percent of the votes, what seats would they analyze.

The underlying concepts are at the heart of the analysis that I did at the end of my report where I'm applying, say, a uniform swing to different elections.

Now I'm not saying that's a complete seats-to-vote curve, but the principle is the same there. So to that limited extent --

Q. We'll come back to that.

Isn't the fact that 32 percent of the wholly nonpartisan plans only give Democrats 42.9 percent of the vote, when they get 53 percent of the statewide vote, at least an indication that the state naturally skews Republican even through neutral redistricting?

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A. Okay. Your question there I think you said 42 percent of the vote, and I think you probably meant to say seats.

Q. Seats. Right.

A. So you're asking is that indicative of political geography? Is that your question?

Q. Doesn't that tend, the natural geography and the concentration of Democratic voters together tend to favor Republicans even in a neutral redistricting scheme?

A. I'm going to answer that the best that I can.

And in general, it's certainly the case that there is a political geography in Michigan that clusters Democratic voters. And as a general principle, that does have some kind of partisan effect as a very, very general matter, before specifically analyzing specific districting criteria. And that's true of a lot of different states.

But one doesn't necessarily lead to the other. You cannot attribute all of that, or even a quantifiable, a specific portion of that to nothing but political geography in the context of, say, the study that I did here because the point is that I'm accounting for not just political geography, but also all of the specific operationalization of districting criteria that I'm programming into this simulation algorithm here.

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Q. But if I understand you correctly, that means the simulated plans are a benchmark for the expected partisan results that would occur under a nonpartisan districting plan, right?
A. There is just a bit of a distinction here between that question and your previous question.
The interpretation of the simulation results that I make is simply to say this is, obviously this number of six, seven and eight Republican seats, this is the sort of distribution that we expect from the combined effect of, number one, obviously Michigan's underlying political geography, voter geography, boundary lines, political boundaries, applying them to the specific criteria that I built into the simulation algorithm. And I won't list all those but we've obviously discussed those at great length today. Building all those things together, all those combine to produce this particular distribution. So that's a fair statement.
It's not a fair statement to say that a particular set of simulations is obviously skewed in a particular way because of voter geography or something like that. That's not something that is a fair conclusion from the simulations I'm analyzing here. It's the combination of all of those things.
Q. Right. But I'll try again. The simulated plans, therefore, after taking all those factors into account, are an excellent

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benchmark for what partisan results should be expected from a nonpartisan redistricting, correct?
A. Oh, what partisan results should be expected from a nonpartisan redistricting process like the one that I programmed. That is correct.
Q. And we agree that's not the only nonpartisan redistricting program, but certainly in your view it's an excellent benchmark for what results we should expect from a nonpartisan process, right?
A. Well I mean obviously you had asked me earlier today to acknowledge that there can in fact be a map drawer that is nonpartisan outside of my computer.
So, again, I'm just qualifying that I'm not speaking for such hypothetical map drawers.
Q. No, but your simulated --
A. I'm speaking for my --
Q. -- are a benchmark for what could be expected to be produced by a nonpartisan process, right?
A. It is a benchmark for what could be expected to emerge from the sort of nonpartisan process that I programmed in my algorithm.
I'm qualifying all of that to say that obviously I'm taking very specific criteria and building them into the computer code, and the computer code is just following those very specific criteria.

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Q. If you could turn to page 25 of your report. And you're writing on page 25 at the top about the efficiency gap from the simulated Congressional plans as presented on page 24, okay?
A. I see page 24 here.
Q. Okay. And you contend that this figure reveals that most of the one thousand simulated districting plans are reasonably neutral with respect to electoral bias, is that correct?
A. Let me see exactly what I said here.
I defined that, or I just made a calculation of, are they within 5 percent of zero. In other words are they between negative 5 to 5 percent. And I did that calculation. And I found that it was over half.
Q. Right. And so a gap within 5 percent is minimal electoral bias in your view?
A. It's a relative term here. I characterized it in that way. I'm not doing it in the absolute sense of saying that you can interpret it in any legal sense. But relative to other efficiency gaps that we see on this figure, obviously efficiency gaps within negative 5 percent to 5 percent are relatively smaller than some of the others that we see.
I really didn't mean that phrase to mean anything more significant than just here is the calculation that I'm doing.
Q. Okay. And you say 22.5 percent of the simulations produced

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an efficiency gap between minus one, which hurts Democrats, and plus one, which helps Democrats, using the 2006 to 2010 statewide elections. Do I have that right?
A. And I think that's referring to another figure. I'll try and identify it here.
Q. It's on page 24.
A. No. I mean it's not referring -- I don't think it's referring to that figure because that sentence is referring to the 2006 to 2010 statewide elections.
Q. And that's set forth on page 24?
A. I gotcha, I apologize. I was misreading there. I apologize for that.
Q. Okay.
A. I see that there. And I can see that I was characterizing that there are -- I mean I obviously did the calculation and I found that there were 22.5 percent that were within minus one to positive one percent.
Q. And it's only the 2006 to 2010 that fall within that category, right? None of the 2012 to 2016 fall within that category?
A. Let me go back to the figure.
And just eyeballing the figure, and again, I can't do the calculations in front of me, but just eyeballing the figure, I believe that's right.
It appears that those, most of those simulated

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plans that are within negative 5 to 5 percent are not within negative one to one percent. And I'm going to guess that that one outlier that we see is also not within one percent.

So it does look like none of those are within minus one to one percent on the 2012 to 2016 election measures.

Q. All right. In the 2006 to 2010, are there any that are positive? You say between positive 0.1, the best I can see is zero.

Is there something above zero? We're all eyeballing this map.

A. Yeah, I'm eyeballing it too.

It looks to me like -- and I obviously don't have the underlying data file in front of me or I could give you a more precise answer. But it looks from this figure that yeah, there are some that are right above zero and some that are right below zero.

But obviously they're all within one percent, they're not very far above. They are all right around that zero percent, that zero percent line, the horizontal line.

Q. Well there are certainly none above 0.05?

A. That's fair to say.

Q. Okay.

A. The point is they're all very, very close to zero, and there may well be some that are positive.

Q. If you can go back to page 25, please.

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Referring to the same simulated plans, you say the simulated plans with nearly zero efficiency gap are all plans that contain exactly six Republican and eight Democratic favoring districts as measured by the 2006-2010 statewide election results, right?

A. I see that sentence there.

Q. Okay. So the only way not to waste Democratic votes in Michigan is to elect eight Democrats.

A. Well that's not my conclusion. I'll put it in more -- I'll put that in more precise terms, which would be fair to say that -- it is fair to say that if you were looking among these one thousand Congressional maps and you wanted to find one that has an efficiency gap using specifically the 2006 to 2010 statewide election measure, rather than the '12 to '16 measure, then you would obviously be talking about plans that are six-eight.

Q. Right. And --

A. But now that was a little bit more limited than the question I think you were posing.

Q. Well if your qualifications on the 2006 to 2010, those are the only ones that are anywhere near zero efficiency gap, and the only way they achieved it was by a plan that you project will elect eight Democrats?

A. Okay. So you're basically just saying, look, on the '12 to '16 election measure, we've obviously discussed that there

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are not any that are right at zero percent. I think that's what you're asking me, right?

Q. Right.

A. Yeah. I affirm that.

Q. It's a lot worse than that actually. For 2012 to 2016, the only results you have are at least 5 percent to 14-and-a-half percent negative efficiency gaps against Democrats, correct?

A. Well I'm affirming that there is obviously a bunch of plans around negative 5 percent that we discussed earlier.

Q. Well the results --

A. I'm just -- I think you started the question by saying it's worse than that, obviously I'm not agreeing to any value judgement about this.

Q. The 2012 to 2016 are worse for Democrats than the results measured in 2006 to 2010, correct?

A. In terms of what, statewide vote share or --

Q. Efficiency gap.

A. It's not -- you're going to have to ask me about a specific group of simulations.

Q. Isn't it true that the efficiency gap measured by the 2012 to 2016 statewide elections have an efficiency gap of at least roughly negative 5 percent to negative 14-and-a-half percent for Democrats?

A. The entire range, you know, obviously starts at a little bit above zero percent. But you're correct in characterizing

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that most of the simulations on that measure, the '12 to '16 measure, go from roughly negative 5 to about negative 13 or 14 percent.

I just want to clarify that there was -- you can see there is one gray circle there that is right around one or 2 percent or so.

Q. Okay. And why does it jump from -- why is there nothing between 5 and 14'ish?

A. Why is there nothing --

Q. Why are there no plans between 5 and 14?

A. Well, that was -- those were the calculations on efficiency gap that I did. I mean I just calculated numbers, and I'm happy to tell you how I calculated the efficiency gap. But I just reported the numbers I calculated.

Q. No, I'm just asking for a commonsense explanation.

My inference is the reason you jumped from five to 14 is because if it's say eight or nine, you'd get a different efficiency gap, and therefore you wouldn't have a wide range of numbers in the middle. You'd jump from one to the other because that's how the efficiency gap works.

But if you have another intuitive explanation, I'm more than happy to hear it.

A. In general what we're seeing there is indeed that there is obviously a correlation between the efficiency gap, a statistical correlation. I mean this is not saying that they

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are somehow equated, but that there is a correlation here.

So recall that I had discussed -- we had discussed a moment ago that all of those plans that are right around zero percent on the '06 to '10 measure have a six-eight partisan composition. And that's just the way that the efficiency gap metric works.

If it's not a six-eight, but instead a seven-seven plan, it's a different cluster. And if not a seven-seven, but instead an eight-six, then that's yet a different cluster altogether.

I think your intuition was basically right, but I just wanted to clarify that that's what it's coming from.

Q. You didn't produce the numbers for how many of your simulated plans produced the efficiency gaps in the 14 percent range that we're looking at? I can't figure that out.

A. How many -- you're asking how many --

Q. Yeah. I just see dots on the page. You never provided the numbers, right?

A. Oh, how many numbers are in each of those clusters?

Q. How many plans, right.

A. I see that I don't obviously have numbers, precise number of dots in those clusters.

Yeah, I'm not sure that I have in front of me right now the data to sort that out. Obviously my underlying data files report those efficiency gap numbers.

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Q. Okay. And give me your rough guess as to the percentage of efficiency gaps above 13 percent using the 2012 to 2016 on page 24.

A. Above 13 percent?

Q. Right.

A. That's going to be a tough one because I'm going to guess that if you draw a 13 percent line right there, there are a bunch of observations right around 13. Do you see what I mean?

Q. All right. Let's make it 12.

A. Okay, great. So you're basically asking how many are in that range from negative 12 to negative 15 percent?

Q. Right.

A. Let me see if I can try and make a bit of an educated guess from my table here.

Okay, I'm going to give you my best guess here. I'll qualify by saying obviously I don't have the underlying data here in front of me. If I did, I'd be able to actually calculate it. So what I'm giving you is a very, very rough guess. And I'm not telling you that this is a calculation that I remember off the top of my head.

So I can see that it's going to be roughly around 12 percent, something in the ballpark of 12 percent of the thousand simulations that are being depicted here, with all those caveats.

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Q. And how many are in the 5 percent range? You're saying 88 percent?

A. You're asking me the same question with respect to the '12 to '16 statewide elections, right?

Q. Yes. It just strikes me as very odd the notion that the right hand is 88 percent when the virtually visually identical left hand is you're claiming 12 percent.

A. And I'm just doing my best to give you a guess here. Obviously I'm not saying that I remember these numbers off the top of my head. Same caveats as before, if I had the data in front of me, I'd be able to give you a more precise answer.

But my best guess here is that, yeah, it appears to be something in the ballpark of 87 percent.

I think what you were alluding to in your question is I think you're saying that it seems odd to you because it looks like there are a bunch of clusters on the left column and there are a bunch of clusters in that middle column and I think you're trying to ask, well how can they be so different in size.

But the point here is what I'm doing in this figure is I am stacking on top of one another a fairly large number of gray circles that are clustered at certain intervals.

And when you see that clustering, sometimes -- it's hard to precisely count up the circles and see exactly how

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many there are in each cluster.

But again my best guess here is 87 percent.

Q. Okay. If you could turn back to page 25.

A. Okay.

Q. You say, to produce a map with a significant electoral bias deviating by over 15 percent from a zero efficiency gap would require extraordinary and deliberate partisan map drawing efforts. Correct?

MR. YEAGER: Can you point out where that is, sir?

MR. CARVIN: The last sentence in the second paragraph.

BY MR. CARVIN:

Q. I'm on page 25, Professor.

A. Okay. I gotcha. I see it.

Q. And I'm just wondering how you can draw that conclusion since at least a substantial percentage of the maps that had no electoral bias produced an efficiency gap of 13, 14 percent. Why would 15 percent be some demarcation line between a map motivated by extraordinary and deliberate partisan map drawing efforts, and the 13 to 14 percent that's produced by maps wholly devoid from partisan intent?

A. Sure. The basis for my opinion on that is that I'm looking at these efficiency gaps that are merging using the '12 to '16 measure. And I'm seeing that there are in fact no maps that have an efficiency gap larger than negative 15 percent.

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In other words, more negative than negative 15 percent.

Q. So we have -- please finish.

A. I was just generally going to explain that so what I'm looking at here is that distribution.

And of course I intuitively know that the sort of plans, because of the clustering that we see in this figure, I intuitively know that you're not going to get a greater than negative 15 percent efficiency gap with an eight-six plan because we're looking at a bunch of eight-six simulated plans here. And all of them have efficiency gaps something in the ballpark of 12 to 13 percent.

So that demarcator as you called it of 15 percent, really to get over that line, we'd be talking about plans that are nine-five in their partisan composition.

Q. So it's really the one Congressional seat, the eight versus nine?

A. Yeah. I'm affirming that it is indeed the case that if you had had a Congressional plan with nine -- with a nine-five partisan composition, you'd be talking about an efficiency gap on this '12 to '16 statewide election measure that would be a bit higher than 15 -- a bit larger than negative 15 percent, probably something closer to about maybe negative 19 percent or so.

Q. Right. So again we're talking about an eight-six plan could be produced by a nonpartisan line drawer, but a nine, for all

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the reasons you previously articulated, requires this partisan intent as you previously described. So this essentially makes the same point is what you're telling us?

MR. YEAGER: Objection compound.

But you can answer.

THE WITNESS: I'll clarify what I am actually concluding here. I didn't hear anything in your question that I thought was incorrect, but I'll just clarify what I concluded.

I'm not sure that I specifically here used the word partisan intent. But I mean obviously I am reaching a result, reaching a conclusion regarding the partisanship, the way in which the partisan composition of the enacted map emerged.

I'm saying here that that sort of plan does not emerge in one thousand simulation tries. And from a statistical standpoint that would be a -- it would be an extreme statistical outlier.

That's all I mean when I say here in this last sentence, would require extraordinary and deliberate partisan map drawing efforts.

I'm obviously not speaking to any firsthand knowledge about partisan effort. I'm simply saying that it could not have resulted from a process like the one that I programmed in my computer simulations. That's what I mean

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when I say deliberate partisan map drawing efforts.

So I just wanted to qualify that that's what I'm opining about here.

Q. Okay. If we could turn to page 21, because I want to ask you the same questions about the median-mean difference.

A. Okay. Let me get there.

Okay, I am at page 21 now.

Q. Okay. And it describes the results of the mean-median difference for the simulated plans, right?

A. Yeah. I see that's what I'm doing in this paragraph.

Q. And you say, second sentence, second paragraph, almost all the computer-simulated plans have a median-mean difference between 2 percent to 3.8 percent, using the 2006-2010, and between 2 to 3.6 percent using the 2012 to 2016 statewide elections, is that right?

A. I see that sentence.

Q. So every computer-simulated plan has a median-mean difference disfavoring Democrats, right?

A. I'm not sure that I actually characterized it as disfavoring Democrats. I see what you're getting at which is to point that the median is higher than the mean, and I think that's all I really characterized it as.

Q. Oh, all right. Are you detracting the notion that a mean-median difference of a positive nature disfavors Democrats?

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A. I mean I'll let it qualify that, if that's what you're asking me about. It obviously -- if you have a mean-median difference or a median-mean difference that is a higher median than mean, obviously that disfavors Democrats in the sense that it makes it harder to win that median district, because that median district is more Republican than the overall statewide.

So just in their middle best district, it's a little bit harder, say in the hypothetical 50/50 participant context.

Q. Right.

A. So, sure. There is certainly an extent to which Democrats are disfavored. I just didn't want to give a blanket statement that every single district has somehow proven to be disfavoring Democrats because of a particular median-mean difference. I just wanted to clarify that.

Q. Is a median-mean difference of, say, 3 percent considered a telltale sign of a partisan skew or partisan gerrymander?

A. It's never been --

THE WITNESS: If I could just ask you to repeat?

(Record read: Q. Is a median-mean difference of, say, 3 percent considered a telltale sign of a partisan skew or partisan gerrymander?)

THE WITNESS: I have never opined, and it's not my opinion, that any one particular threshold of a median-mean

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difference, whether 3 percent or anything else that you could name, is somehow a, quote, telltale sign. I always analyze the median-mean difference, the median-mean difference of a plan in the context of the actual states or the actual jurisdiction that we're considering here.

Meaning that here obviously I'm considering a particular median-mean difference in the context of a number of computer simulations in the distribution along the median-mean difference.

BY MR. CARVIN:

Q. Right. You're always comparing the difference. And I'm just trying to figure out is there anything about the simulated plans' rough average of I'll say 3 to 3.5 percent, do you know how that stacks up nationally?

A. Do I know how it stacks up nationally? I can't say that I've done a comprehensive national study and can really characterize for you whether the median-mean difference viewed in a particular Michigan plan is at the tail end or well within the middle of the distribution. I really haven't studied that question.

Q. Do you know how 6.7 percent ranks nationally?

A. Same answer as before. I don't have -- I don't have empirical basis to say that I've actually looked at the distribution nationally and can rank what a 6.7 percent would rank nationally across all 50 states.

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Q. If you could turn to page 41, please.

A. Yes, sir.

Q. Okay. And it's fair to say that looking at 2012 to 2016 statewide elections, the vast majority of the simulated plans give Republicans 58 seats?

A. I report here 74.9 percent, so that is certainly probably the vast majority or at least a very sizable majority.

Q. And 91.8 percent of the plans give Republicans 58 or more seats, right?

A. I'm guessing you took 74.9 percent and you added up 16.7 percent to that?

Q. Right.

A. Roughly in the ballpark of 92 percent. Is that what you said?

Q. Yes.

A. Okay. I affirm the math or close enough. I affirm that you're pretty close probably.

Q. So again, this -- for the record, how many seats are there in that Michigan House?

A. We're still talking about the 2012 to --

Q. No. It's 110 seats in the Michigan House.

A. I gotcha, I apologize for misunderstanding your question.

Yes, there are 110 seats or districts in the Michigan State House.

Q. So even these 90 plus percent of these completely simulated plans would give Republicans a three-seat majority in the Michigan House, even though they are completely devoid of partisan intent, right?

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A. No. I'm not sure that's quite right. I don't really see -- okay, you're asking about the 74.9 percent of the simulations, right?

Q. Or 59 or 60.

A. Okay. I apologize, I misheard the question.

Obviously I agree that if the Republicans have 58 out of 110, that's a three-seat majority. And again in 74.9 percent of the simulated plans that's what we see. And obviously the same applies to that 92 percent figure we both calculated earlier.

Q. Right. And in the real world, in 2012, the Republicans won 59 seats in the House, right?

A. In 2012 you said?

Q. Yes.

A. To my recollection, that is the case.

Q. And that was the first year this was implemented. So in the first year after implementation, they achieved a seat share not different from what you would have expected under a totally nonpartisan redistricting plan, right?

A. No. I mean what you did there is just an apples-to-oranges comparison. You are comparing the actual endogenous elections --

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Q. Yes, but I --

MR. YEAGER: Let him finish.

BY MR. CARVIN:

Q. Go ahead.

MR. YEAGER: Unless you want to withdraw the question.

BY MR. CARVIN:

Q. No. I'm perfectly happy to clarify.

A. I think I understood the question.

What you did there in your question was to compare the number of Republican seats in the legislative elections in the House elections themselves.

Q. Right.

A. But then you compared that to a distribution here in figure 13 where I'm reporting on the distribution with respect to the number of Republican seats using the 2012 to 2016 statewide elections aggregated.

Q. Right.

A. And so that's -- that's obviously an apples-to-oranges comparison. You can't just say, well there was 58 in the State House legislative election results, and that is somehow equated to the number 58 on this figure, which is calculated using the 2012 to 2016 statewide election results.

Q. I'm somewhat puzzled why you think your statewide elections, which are designed to predict, or designed to assess

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elections in the real world, are apples, and the real world election results are oranges.

You're telling me there is not really much -- there is a very significant difference between your statewide elections and elections in the real world?

A. That's not what I'm saying. What I'm saying is that if you want to directly compare the enacted plan to a distribution of simulated plans --

Q. Right.

A. -- you need to evaluate both of those sets, both of those things using the same statistical metrics, the same quantified metric of partisanship.

And so certainly I do that in figure 13. The question that you had posed a moment ago was not doing that. You were using one set of elections on one side to evaluate the enacted House plan, and then another set of elections to describe the simulated plans.

Q. Right. You're predicting --

A. That's what is an apples-to-oranges comparison.

Q. You've assigned 61 seats to the House on the basis of statewide elections which were exogenous. In the real world they got 59, right?

A. Okay.

Q. Is that true?

A. Your characterization was not correct. So I'm happy to go

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and correct that here.

Q. Your assessment of the expected Republican seats under the enacted House plan based on the 2012 to 2016 statewide votes is 61, is that correct?

A. The 61 refers to --

Q. Is that correct?

A. I'm not sure that's how I would characterize it. I'm just going to put it in my own words and I think this is responsive to your question.

The 61 for the enacted House plan that we see with the red line, that refers to the number of districts in the enacted House plan out of 110 that have more Republican than Democratic votes in the 2012 statewide elections.

Q. Right. And in the real world they got 59 in 2012, correct?

A. And now you're talking about --

Q. Is that correct?

A. I'm just -- I just want to clarify my understanding of your question.

And now you're talking about the actual State House election results. And I'm affirming that indeed in the State House election results in 2012, it was 59.

Q. Okay. And that you think that the comparison of the real world election results and the number that you have assigned 61 is a comparison of apples and oranges, is that your testimony?

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A. What I said is apples and oranges was to say that somehow taking the number 59 from the endogenous elections, and then comparing that to the 58 or 59 here that we see in this distribution, using the exogenous elections, would be a valid comparison. That's what the apples-to-oranges comparison that I was referring to is.

Q. Right. The results produced by the 2012-2016 statewide elections, and the results produced in the real world are apples and oranges?

A. That's not what I said.

I said to equate by saying that the enacted House plan is to be evaluated using a different election than the 2012 to 2016 statewide election, that comparison of the enacted plan to a distribution would be an inappropriate apples-to-oranges comparison.

Q. Okay. Now let's assume the result was 62 using the statewide elections. That would obviously be impossible to do absent a severe partisan intent, correct?

MR. YEAGER: Objection, incomplete hypothetical.

You may answer.

THE WITNESS: Okay. When you're saying 62, I'm not sure if you are referring to a hypothetical State House election result or if you're referring to --

BY MR. CARVIN:

Q. Any plan that produces 62 Republican seats as measured by the

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2012 to 2016 statewide elections is necessarily a product of partisan intent, right?

A. Okay. So you're asking if I had seen a plan, if I had seen an enacted plan, would I have reached that conclusion?

I would look at this distribution. If we had a plan all the way out at 62, I would have concluded that that creation, that plan's creation of 62 Republican seats is a statistical outlier on partisanship that is not something that generally ever really occurs in these one thousand simulations.

Q. And it wouldn't be possible to produce that result if there was no partisan intent behind the line drawing, right?

MR. YEAGER: Objection, incomplete hypothetical.

You may answer.

THE WITNESS: My conclusion is limited to saying the following, that such a plan, a 62 plan, a 62 Republican plan could not plausibly have been the result of a nonpartisan districting process of the sort that I programmed into my, in my expert report, obviously with the nonpartisan criteria that I built into the computer code.

So that's what I mean when I say this is a partisan outlier.

BY MR. CARVIN:

Q. Okay. If you could turn to page 51, please.

Just to make it clear, we're now talking about the

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House plan, because we've been jumping around a little bit. I'm going back to what we were talking about before.

And you say, do you not, at the top of page 51, that the mean-median figure reveals that most of the one thousand simulated districting plans reflect a small amount of electoral bias in favor the Republicans -- I apologize, that's referencing the efficiency gap, I may have just misled you.

On page 49 you describe what you're looking at in terms of the efficiency gap, and at the top of page 51 you give the example.

A. Okay. You're at the sentence that says the fact that the one thousand simulated plans in figure 17, is that right?

Q. Yes. Well I actually think we're looking at figure 18.

If I misled you, I want to go to the efficiency gap numbers now in the House.

A. Okay. I'll just -- if it's helpful I will point you to where the text is and maybe this is where you're trying to point me to.

Page 51 --

Q. Right.

A. -- second paragraph, is that where you're going?

Q. Right. And your description, just so I'm clear is that most of the one thousand simulated districting plans reflect a small electoral bias in favor of Republicans. Do I have that

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right?

A. Significantly more wasted Democratic votes than wasted Republican votes, yes. So, yes, you could characterize that gap as a small bias in favorite of the Republicans.

Q. And if you look at the graph on page 50, the 2012 to 2016 numbers?

A. Okay.

Q. It looks to me, given these clusters, that the substantial majority of the plans have an efficiency gap of negative nine to negative ten, is that fair?

A. Around that cluster, I see the two clusters you're talking about. And, yeah, I can see there with one cluster that's roughly from about, we'll call it maybe about 8.7 to roughly 9.3 or so. And then there is another cluster to the left of that that's around maybe 9.8 or so to about 10.2 or so.

Q. Right.

A. I think those are the two clusters you're referring to.

Q. Right. Would you say that an efficiency gap of nine or ten reflects a small amount of electoral bias?

A. I wouldn't really ever characterize something in absolute term. It's all relative. I have to know small compared to what.

I would certainly characterize it as -- I would characterize it as small in relation to the enacted plans, the efficiency gap. It's small in relation to--

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Q. I thought the enacted plan's efficiency gap was 12.1 percent under the '12 to '16 numbers. Do I have that wrong?

A. That sounds about right. I see that's right around 12.1 percent. So I was answering the previous question.

I was just saying that -- you were asking me if I could characterize that as small, and I usually just need to know small in relation to what.

Certainly it's small in relation to a 12.1 percent --

Q. Ten is small in relation to 12?

A. Okay. I just want to try to finish answering your previous question first.

Q. Okay.

A. It's certainly small in relation to the enacted plan's efficiency gap of negative 12.1 percent. It really just depends on what the context is.

So I would characterize in that context as small, but obviously I'm not opining that a general efficiency gap of say, 9 percent is small in any absolute universal sense.

Q. How would you characterize it without reference to the comparison to the enacted plan?

A. Well I would characterize it as just what I've been saying. It's roughly 8 --

Q. Would you characterize it as small?

MR. YEAGER: Asked and answered.

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THE WITNESS: What I just said --

BY MR. CARVIN:

Q. Without reference to the enacted plan, would you characterize it as small?

MR. YEAGER: Asked and answered.

You may answer.

THE WITNESS: Without reference to the enacted plan or any other sort of benchmark or reference points, I'm not really sure that I can really, I can really answer that.

It's always within reference to some kind of benchmark.

It would be like if I asked you is 58 a big number? And obviously there is no right answer to that, it depends is 58 bigger than some other number. You need a reference point.

And I'm just saying if the enacted plan is the reference point, then I'm able to say that.

BY MR. CARVIN:

Q. That's entirely right, you need a reference point. And our reference point for plans that are completely unbiased drawn by your neutral process produce an efficiency gap of 9 to 10 percent. We therefore must analyze the enacted plan as 12.1 percent in light of that gap, correct?

A. Well that's certainly what I do. I analyze the enacted plan in reference to the distribution of the simulations.

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Q. Right. And in other circumstances, a 9 to 10 percent efficiency gap could be characterized as severely anti-Democratic. You've been involved in litigation where it's been characterized that way, haven't you?
A. I'm not specifically aware of that. I'm happy to take your word for it. Obviously I've said that's not the sort of characterization I ever make in my academic work or expert work. But --
Q. But -- please.
A. I'm happy to take your word for it that out there that other people, may be litigants who like to put those kinds of characterizations.
Q. This number reveals, does it not, that there is a relatively large inherent bias against Democrats under a neutral Michigan redistricting plan that produces a 9 to 10 percent efficiency gap?
A. I'd said what it generally reveals if you're producing a partisan-neutral redistricting plan for Michigan's House districts, and you follow a specific criteria that I followed in my computer code, which we've talked about at length, then you're generally going to end up with efficiency gaps in this range that we've been talking about. I think that's an accurate characterization.
Q. And even holding apart from partisan intent, you would have a relatively substantial efficiency gap disfavoring Democrats

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in Michigan, correct?
A. I mean it's fair to characterize that efficiency gap as a range, as one where clearly there are some more number of wasted Democratic votes than wasted Republican votes. That's how I would characterize an efficiency gap in this sort of range that we're talking about.
Q. All right. Well let's talk about the mean-median difference from the House, right?
You characterized the -- I'm now on page 49. And you say that the small mean-median differences in the computer-simulated plans reflects a modest skew. Right? That's how you characterized it, a modest skew?
A. Yes, I see that sentence.
Q. If you'd turn to page 47.
A. I am there.
Q. Okay. You can see that the mean-median difference using the 2012-2016 statewide elections is 4.5 to 6 percent, correct?
A. Okay. You're in the second paragraph where it says using the 2006 to 2010 statewide elections --
Q. I'm actually in between --
A. Right. I know what you're talking about. And between 4.5 percent to 6.0 percent, using the '12 to '16 statewide elections. I see that sentence.
Q. And the mean-median difference in the enacted plan is 5.19 percent using admittedly the 2006 to 2010 statewide

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elections, correct?
A. Let me just try and see where I reported that number. And 5.19 percent, I see that, okay.
Q. So that is very much a modest skew, very much in line with the mean-median difference produced by the completely nonpartisan simulated plans, right?
A. No, you're talking about an apples-to-oranges comparison here again.
Q. All right.
A. When we're calculating a median-mean difference, here is the essential points of the mean-median difference. And I really want to explain this because it's such an important point.
The median-mean difference is calculated as the difference between the median district and the mean district vote share. It's not exactly the same, but it's usually very similar to the overall statewide vote share. If you take the mean of all 110 House districts, you're getting something close to, not precisely, the overall statewide vote share in all of Michigan.
So that is a measurement, this median-mean difference is a measurement that is anchored around, maybe with reference point to, the overall partisanship of the states in whatever set of elections were analyzed.
So if there is a difference in the overall partisanship in one set of elections versus another, then

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you're talking about a somewhat different anchoring point in the median-mean difference.
Q. I got it.
A. So what that means is just that when we're making comparisons between the enacted plan and the simulated plans, using the median-mean difference, you really have to be sure to make an apples-to-apples comparison using the same set of election results.
Q. All right. But you're not retracting your statement in the report that the 4.5 to 6 percent mean-median difference in the simulated plans is a modest skew, are you?
A. I'm just trying to find where we are here.
Q. I just read it to you from page 49. You characterized the 4.5 percent to 6 percent as a small median-mean difference that reflects a modest skew.
A. Which line are we on where we have the 4 percent?
Q. The 4.5 to 6 percent is on page 47.
A. Okay, I gotcha.
Q. And you characterize that mean-median difference, as well as the other one, you characterized it as small median-mean differences in the computer-simulated plans that has a modest skew.
Do you see that on page 49?
A. Now we're back to 49. I just want to understand where you are, where you're reading from.

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And can you point me to the line on 49 that you just read from?

Q. The second sentence on page 49. The small median-mean differences in the computer-simulated plans may also partially reflect a modest skew in Michigan's voter geography that slightly benefits the Republicans in the district. This modest skew in the simulated district plans, and you go on.

A. I gotcha. Sure. I'm happy to explain the basis of that if that's what you're looking for.

Q. I'm not asking that. I'm asking whether or not the 5.19 percent median-mean difference is also a small median-mean difference?

A. No. I wouldn't characterize that as a small median-mean difference.

Q. Then why is 4.5 to 6 percent a small median-mean difference, but 5.19 percent is not?

MR. YEAGER: Objection, misstates the documents. You may answer.

THE WITNESS: I'm going to try to clarify here. As I said before when we were distinguishing the efficiency gap at length, to characterize something as small, you do it in the context of some kind of reference point.

So when we're talking about the median-mean difference of 5.19 percent using the '06 to 2010 statewide elections, I'm characterizing that as extreme with reference

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to the distribution of simulations as measured using those exact same statewide elections.

So if we switch to another set of elections, then that obviously is talking about a different reference point.

BY MR. CARVIN:

Q. Right.

A. So again with a different reference point, what something -- what makes something relatively small or relatively large is going to change depending on that reference point.

So that's the point I'm trying to clarify here, which is that when you're going to compare, say, the enacted plan's 5.19 percent, it's with reference to the distribution of simulated plans as measured by the same set of elections.

Q. They go up to 4-and-a-half percent?

A. Right.

Q. So the difference between 4-and-a-half percent and 5.19 percent you would view as substantively significant?

A. Again, first I'm not -- I'm looking at the figures here and I'm not quite sure they go all the way up to 4-and-a-half percent. I can see they come sort of close.

Q. It's your number on page 47.

A. Okay. I appreciate that. I think they stop a little bit short.

But the general point here is I don't really have an opinion on trying to, other than to say it's an

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apples-to-oranges characterization, I don't really draw any conclusions from trying to compare --

Q. You don't?

A. -- the median-mean gap using one set of elections in an enacted plan directly compared to a set of simulation calculations using another set of elections.

Q. Well I'm --

A. But I'm generally --

Q. But --

MR. YEAGER: We're going to stop until he can just answer.

(At 4:55 p.m. went off the record.)

(At 5:05 p.m. went on the record.)

MR. CARVIN: Back on the record.

BY MR. CARVIN:

Q. If you'd turn to page 52 of your report, please.

A. Yes.

Q. As we alluded to previously you did a uniform swing analysis on the durability of the enacted plan's partisan bias, is that right?

A. Yes.

Q. Okay. And what you do in those circumstances is you ask what percentage statewide swing would be needed to give Democrats half the seats in each of the relevant bodies?

A. That's right.

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Q. Okay. And basically what you're trying to figure out is whether a party -- I'm now quoting from the last paragraph on page 52, whether a party's majority control over a legislative chamber or congressional delegation is strong enough to withstand a reasonable range of alternative electoral conditions, right?

A. I want to try to find that.

Q. The last paragraph.

A. First sentence, right, first, last paragraph.

Q. Right.

A. I see it, I gotcha.

Q. What would be a reasonable range of alternative electoral condition in Michigan for the rest of the decade?

A. It's not a question that I specifically analyzed. I didn't look at the distribution of all swings.

I was simply characterizing the swing that would be necessary to flip or to tie the partisan control of each chamber.

Q. Well if you turn to the last sentence on page 53, you do state that this Republican majority control would also have been durable even under a reasonable range of alternative electoral conditions.

So what did you mean by a reasonable range of electoral conditions in that sentence?

A. Well like I said, I didn't characterize it as a precise

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threshold. I just calculated the various swings that were necessary.

Q. Right.

A. I reported those swings on Table 5.

Q. Right. But I'm trying -- please.

A. Okay. Okay. I reported the numbers on Table 5. And I don't mean reasonable range in any precise sense other than to say that certainly they all are negative swings that are necessary. And they're certainly all larger, at least a little bit larger than one percent, and often several more than one percent.

I didn't take -- I didn't take a particular threshold and say, if it's above one percent or if it's above two percent, that would be a larger swing or a smaller swing.

Q. Would 3 to 5 percent be a reasonable swing?

A. It really depends on the context. I would need to have more specific information.

Q. In Michigan.

A. Right. I understand.

Q. In 2018, would a 3 to 5 percent swing be reasonably expected or quite unreasonable?

A. It's really not just a question I analyzed.

Q. So you don't know. How about 7 or 8 percent?

A. Same answer there. I mean it's context dependent even depending on the specific set of elections that we're talking

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about, but again I'm saying it's not something that I analyzed.

Q. Okay. If you'd turn to page 65, please.

A. Okay.

Q. This is the, your table showing the past statewide results, right, Congress, etcetera?

A. Yes, I see this.

Q. Okay. You can see for example in one election between 2008 and 2010 the Republican vote share went from 45.65 to 54.15. Right?

A. I see that.

Q. Okay. So we had a 9 percent -- or 8-and-a-half percent swing in one election cycle. Is that unusual?

A. Well what you did to get to that 9 percent or 8 percent or so is to take the difference between 2010 to 2008.

Q. Right.

A. That's not necessarily what's -- what you're doing in any sort of uniform swing analysis all the time.

Obviously this is an unusual pair of elections in that in general the Democrats did quite well in 2008, and in general the Republicans did quite well in 2010. There were extreme partisan tides in the opposite directions, but that's not to say that certainly a one election to the next swing of 8 percent is to be commonly expected. That was an unusual pair of elections back to back.

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Q. Well what about the next election after that? What happened then?

A. What happened from --

Q. In 2010.

A. From 54 to 47 --

Q. After we go from 55 to 44 we go from 54 to 47 in the next election cycle. So you have an 8-and-a-half percent swing and then a 7 percent swing back to back.

A. And you're asking me --

MR. YEAGER: Object, it's not 7 percent.

THE WITNESS: 47.6 percent I think is what you're trying so say.

Sure. So I'll answer with respect to that.

I mean that actually brings a different set of factors in because obviously what happens in 2012 was not just a change from the 2010 Republican tide year, but there was obviously also redistricting. So you have a different set of Congressional races that are factoring into the number that's being reported there.

So the point is if you just want -- if you're just asking is the math correct, certainly there is a swing there that is something on the order of 6 or 7 percent or so. But the point here is that there are obviously factors that go into making it not-terribly reliable just to say let's look at the difference from 2010 to 2012 or from '08 to 2010, and

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characterize that as a typical or not typical uniform swing.

BY MR. CARVIN:

Q. Well let's go back to Table 5 on page 57.

A. Okay.

Q. All right. We see here, if there is a uniform swing of as little as 3.37 percent from the 2012 year, then Democrats will win at one-half of the Congressional districts.

Are you opining that a 3.37 diminution in Republican votes share in 2018 or 2020 is unlikely?

MR. YEAGER: Objection, vague and ambiguous.

You may answer.

THE WITNESS: Okay. I'm not giving an opinion as to whether in general a 3.37 percent swing in the Democratic direction is, as an absolute matter categorically likely or unlikely. It's certainly context dependent.

To give a more concrete example, let's suppose we had a really good Republican year, a historically good Republican year, whatever the vote share was in that year. How likely is it that in the next election the Republicans would do even better and have another 3 percent swing in the Republican direction?

Well knowing that the benchmark for that was an already good Republican year, that's probably less likely.

But let's suppose the converse, that we just had a really good Democratic year, an historically good Democratic

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year. How likely is it that in the next election, from this previous really good Democratic year, will we have a swing of 3 percent in the Republican direction.

That's obviously a lot more likely. That's what I mean when I say it's context dependent. There is no absolute answer when you're trying to compare one election to the next --

BY MR. CARVIN:

Q. So you're not opining that a 3.37 percent swing from the Republican vote share in November of 2012 is outside of the range of reasonable alternative electoral conditions for 2018 and 2020, correct?

MR. YEAGER: Please finish your prior answer, Professor, unless he withdraws the question.

THE WITNESS: Okay. I'll finish what I was saying before and then I'll let you ask your next question.

My point was just generally that it's context dependent. And certainly the sort of reasonable swings from a prior election, which is what you were just asking me about that one can expect, depends on whether that prior election was a really good Republican year or really good Democratic year or a neutral year, or whatever.

That's the point when I say -- that's what -- that's the basis of why I'm saying you can't just give an absolute answer as to this is or is not a large or reasonable

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uniform swing.

BY MR. CARVIN:

Q. And you haven't analyzed any of the contextual factors that would affect the swing in 2018 or 2020, right?

A. I haven't analyzed the 2018 elections at all so I'm not making any predictions or saying what sort of uniform swing --

Q. So you're not opining that a 3.37 percent uniform swing is outside the range of reasonable alternative electoral condition in 2018 or 2020, correct?

A. Swing compared to what? Are you talking about a swing from 2016?

Q. 2012.

A. Oh. From '12. So you're saying would the difference between the 2012 to 2018 elections, could we see a 3.37 percent uniform swing? That's the question, right?

Q. Yes.

A. And I haven't specifically analyzed that. In part because again, to go back to my earlier answer, I'm not an elections forecaster here. I'm not making a specific prediction about what is the probability that we'll see a particular outcome in the specific 2018 or specifically the 2020 election.

Q. And since you haven't analyzed it you are not opining that a 3.37 percent uniform swing from the 2012 election results is outside the range of reasonable alternative electoral

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conditions in 2018 or 2020, correct?

A. With respect to the 2018 elections and the 2020 elections, I am not even forecasting what those elections would, results would be. So I'm obviously not going to be able to opine on a specific prediction about what kind of uniform swing we might or might not see. That goes back to election forecasting.

Q. Right. So you're not making any prediction as to whether or not, in any of the three seats, whether or not Democrats will -- whether Republicans will retain majority control under reasonable alternative electoral conditions?

A. In any of the three seats?

Q. Any of the three chambers at issue.

A. Any of the three chambers?

Q. Sure.

A. Okay. Am I making a prediction as to whether the Democrats would win one-half or the Republicans would retain control?

I mean that's a separate question. And again I would say that the same caveat as before, I'm obviously not forecasting specific 2018 election outcomes. But in expectations, we would certainly not expect the Democrats under the current districting plans to win one-half of the current districts in any of those three plans.

Q. Now I have to ask the same question again.

So you're saying you certainly would not expect a

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3.37 percent uniform swing from the 2012 election results in Congress in either 2018 or 2020?

A. I think that's the same question that I just answered so I'm going to answer that question as I understood it.

And again what I'm saying here is I'm not making a specific election forecast about 2018. But again, in the long term, in the long-run expectation over any number of elections, we normally don't expect to see such a uniform swing of a negative 3.37 percent.

Q. You don't? Why is that? What's the average swing throughout a decade in state legislative races?

A. I'm not sure I could tell you that off the top of my head. I'd need a definition of what you're talking about. Are you talking about the change from '12 to '14? Something like that?

Q. Throughout the decade, what kind of changes in either direction is typical in the majority of state legislative elections?

MR. YEAGER: Objection, vague and ambiguous.

You can answer.

BY MR. CARVIN:

Q. Do you know?

A. It's not something I can tell you off the top of my head.

Q. What's the range?

A. Same answer as before. I don't have those numbers in front

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of me to give you precise numbers.
Q. So you don't know if 3.37 percent is well within the expected range of swings, correct?
A. What I am saying here is that over the long-term average we don't expect to see -- in long-term expectation we don't see it. And obviously again I'm not saying with respect to a particular election we will or will not see uniform swing of a particular size.
If what you mean by uniform swing is the change from say '12 to '14, or the change from '14 to '16, that's a specific -- that's another specific definition of a uniform swing, and certainly we have the numbers in front of us here to at least characterize a little bit of what those swings have been under the current decade.
But that's a different analysis altogether.
Q. What is your reasonable expectation in the long term for whether or not there will be a 3.37 percent uniform swing from the 2012 Congressional election results?
A. I'm not sure I understand the question.
Q. You keep saying that you're not making any forecast for 2018 or 2020, you're talking about long-term expectations. What is your long-term expectation for a likely or reasonable uniform swing from 2012 election results for Republicans?
A. Okay. My answer is going to be that I haven't done that specific study.

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Q. All right. And can you turn to page 57?
A. Okay.
Q. Okay. For the State Senate, you say they need a 6.4 percent uniform swing, for Democrats to win one-half of the Senate districts, correct?
A. We're talking about November 2014 Congressional --
Q. Right.
A. -- second row? Yes, I see the 6.45 percent.
Q. And November of 2014 was an excellent year for Republicans in the Senate, right? Your statewide excellent predictor of seats predicted 23 or 24, when in fact they won 27, is that right?
A. Okay. We're talking about the State Senate elections now.
I agree that the November 2014 elections were good for the Republicans.
Q. Is it an unreasonable alteration in electoral conditions that there will do 6.4 percent worse in any elections during this decade?
THE WITNESS: Could I have that read back?
(Record read: Q. Is it an unreasonable alteration in electoral conditions that there will do 6.4 percent worse in any elections during this decade?)
THE WITNESS: I think it's fair to say that that would be a fairly large gap to overcome. Again, I'm not forecasting to say that it could never happen. I'm just

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saying that in general in expectations we don't expect a uniform swing that large.
BY MR. CARVIN:
Q. Who is we? Why don't you expect that?
A. Sure. Obviously by we I'm speaking for myself here.
Q. You haven't analyzed the issues so how can you have expectations one way or the other?
A. Sure. I'm saying I haven't precisely calculated a threshold for each particular set of elections showing a distribution of what sort of uniform swings we would or would not expect.
And this is just based on my general looking at election results in Michigan, which I'm not saying that I've done a specific study to calculate a threshold.
Q. Well what's been the most recent history in the Senate in terms of swings statewide?
A. You're asking about a swing from one election to the next? Or you're asking from a long-term average?
Q. Either.
A. I don't have the data here in front of me to be able to give you any sort of precise number.
Q. Turn to page 65, please.
Again we see, do we not, between 2006 and 2010, in one election cycle we see a nearly 9 percent increase in Republican vote share?
A. Okay, I got you. You're pointing to the second part of this

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table here.
Q. Right.
A. So I appreciate that you're pointing me to some actual election data here. And, sure, I can affirm your math that from say '06 to 2010 there is a swing of something almost like 9 percent. That's not necessarily how I would answer the question of what sort of uniform swings we would expect.
So I think your question was just about the math, so I'll stop there because I think I answered your question.
Q. Okay. But you haven't analyzed swings in any way for State Senate elections in Michigan, right?
A. I wouldn't say I haven't analyzed them in anyway. I haven't analyzed it specifically with an eye towards answering the question that, about what is or is not a reasonable uniform swing.
I mean I think in general one wouldn't do so by saying, well, look, we've got a change from '06 to 2010 of about 9 percent, so clearly that's typical. That wouldn't really be the appropriate way to do it.
You might do something like looking at the long-term average.
Q. And -- go ahead.
A. Okay. I was just going to say one might look at the long-term average --
Q. But you haven't looked at the long-term average, have you?

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A. Okay, I'm just going to finish answering the previous question. And then I'll try to remember this question.

So one might do something like looking at the long-term average, and then saying what were the swings during individual elections from that long-term average, and what range was actually possible, or what ranges were observed.

And then I think your next question was whether I've done that, and obviously I said, no, I haven't specifically done that.

Q. Okay. If I ask you what you've looked at, it would be very helpful because we're particularly short on time, if you could answer that question, rather than hypothesize what one could do. Is that okay?

A. All right. I appreciate that.

Q. Thank you. If you could turn to page 57?

A. (Witness complied.)

Q. Okay. Now the uniform vote swing we need to give Democrats one-half of the House districts, if you look at 2012 would be a change of one percent -- 1.04 percentage points.

Are you going to opine that a swing of 1.04 percentage points from the results in 2012 is outside the range of reasonable alternative electoral conditions in 2018 or 2020?

A. Well the point here is that it hasn't happened. We've seen

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three election results and it hasn't happened. And the same qualification before in that I'm not opining that in general a particular uniform swing is or is not likely. It's always context dependent here. But certainly we haven't seen such a uniform swing from the 2012 election results.

That is not to say, however, that one would never expect to see a 1.04 percent uniform swing from some election result. That, again, is another separate -- is a different question altogether.

But specifically from the 1.04 percent listed there in November of 2012 row, we haven't seen 1.04 percent swing.

Q. We haven't? Well let's turn to page 65 again, right?

You're saying, I take it, we haven't seen that swing in 2014 and 2016, was that your point?

A. We haven't seen the swing from the 2012 result is what I was saying.

Q. From meaning since?

A. No. No. No. No. From meaning take the results of the 2012 and subtract 1.04 percent from every district. That's what I mean by from 2012 .

I'm not saying was there such a change from '14 to '16. Obviously there have been swings from one election to the next larger than 1.04 percent. That's goes without saying.

Q. Right. For example from between 2010 and 2012 they lost,

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what, roughly 7 percent in one election cycle?

A. That's right. 2010 was a really strong Republican year.

Q. Right.

A. And then 2012 was kind of a strong Democratic year.

Q. Right. And if 2016 was a strong Republican year and 2018 was a strong Democratic year, there is no reason not to expect a swing of equal magnitude, or certainly more than the one percent, right?

A. And now we're talking about swings from one election to the next, and you're specifically talking about the 2016 election.

Q. Right.

A. We're no longer talking about the 2012 election where that 1.04 percent number came from.

Q. Right.

A. And I agree with you that certainly 2016 was obviously a pretty good Republican year. And if, very hypothetically, there were to be a strong Democratic year next, then certainly we may very well expect a swing of over 1.04 percent.

Q. Well let's look at page 57.

In this very good Republican year of November 2016 a swing from 4 percent, just 4 percent between that and 2018 would give Democrats one House -- one-half of the House districts. You are not opining in any way I take it that a 4

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percent negative swing against Republicans is at all unlikely from 2016 to 2018, is that right?

A. Did you say unlikely?

Q. Yes. Is at all unlikely.

A. Is at all unlikely.

I'm not sure that I've done the analysis to be able to specifically answer this. I haven't done the analysis to be able to specifically answer that.

But I'm just pointing out that was a very different question from asking whether a particular uniform swing from the 2012 results was likely.

Q. Now the response to my different question is that you've done no analysis and cannot opine whether it's likely or unlikely that Republicans will get 4 percent less statewide vote than they got in 2016, right?

A. I agree it's not something I've specifically analyzed.

Q. Or analyzed in general?

A. Well I've generally looked at election results, but I'm agreeing that I have not specifically analyzed the question that you posed to me.

Q. And you're asking the question how much would it take to give Democrats one-half of the House district. Right?

A. In the bottom --

Q. In the House.

A. Okay, I gotcha.

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Q. Why would you ask that question when the non-simulated plans give Republicans roughly 58 percent -- 58 of the House districts? Isn't the relevant question what swing is necessary to return them to what occurred under the simulated plans?

A. I'm not sure -- you just said in your question when the non-simulated plans gave the Republicans 58.

Q. I'm sorry, if I said -- let me rephrase the question.

As we discussed at length the vast majority of the nonpartisan simulated plans would have given Republicans 58 seats under the way you analyzed that. If that is true, shouldn't we ask ourselves what would the vote swing be necessary to give Republicans 58 seats instead of 55 seats?

A. Okay. I gotcha.

I agree that there is a possibility, or one can do that, as a purely statistical matter. You can certainly take districts from a simulated plan, analyze them using statewide elections, and then apply various uniform swings to see what the effect on the number of Republican seats would be.

I didn't do that analysis here. That analysis wasn't appropriate for the question that was put forth to me here. So that's why I didn't do it here.

Q. All right. The uniform swing analysis assumes an equal swing in every district, right?

A. That's essentially what it does. You're applying various

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hypothetical swings at an equal percentage in every district.

Q. Right. And your touchstone for when they achieve half of the House districts or half of the Senate districts or half of the Congressional districts looks at the vote needed in the median district to turn Democrat, right?

A. If I could ask --

Q. You're looking at the median district percentage, right?

A. I gotcha. You're saying for the purposes of calculating whether or not Democrats are going to be able to win one-half.

Q. Right.

A. It's not quite -- I get why you're saying that. It's not quite literally the median district. And it's just a small technical thing, you can feel free to cut me off if you don't want to hear the technical explanation.

When I say one-half of the House districts or one-half of the Congressional districts in this table, I'm saying 55 out of 110, or seven out of 14 of the Congressional districts.

To win that you don't literally need to win the median district. The median district is statistically calculated as, for the House plan, the mid point between 55 and 56. Just a small technical point. That's what we mean by the median. That's just statistically how you calculate the median.

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To calculate the median Congressional district, you're calculating the midpoint between number seven and number eight.

Q. You're looking at the vote swing necessary in the 7th district, the 7th most --

A. For the Congressional plan that's what's going on here in this figure.

Q. Okay.

A. It's the 7th ward, in the House, it's the 55th.

Q. Isn't it true that the vote swings in the most competitive districts in state tend to change more than the statewide average?

A. That is not a question I have analyzed in the context of these districts.

Q. Doesn't it make sense that if elections are competitive, the Democrats, the Republicans are going to be putting a lot more resources and candidate recruitment into those districts that are winnable, than they would in either safe Republican or safe Democratic districts in order to achieve a majority?

A. That is not a question that I've analyzed in my work here.

Q. Have you thought about it?

I'll just ask you generally. Do parties put more money into competitive elections that will swing a legislative body in their favor than they do into safe seats that will have no effect on whether or not the body swings?

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You haven't looked at that?

A. Again I'm going to say that's outside of my expertise.

I'm obviously aware of that as a general strategy. I can't say that's within my expertise to say that's a general pattern that's happening in Michigan.

Q. Okay. If you could turn to page 56, please.

Okay. On page 56 you analyzed -- you say that Congressional Districts 1, 4, 5, 8, 9, 10, 11 and 12 are partisan outliers?

A. I see that paragraph there.

Q. Okay. And you conclude from that these are the most effectively cracked and packed districts in the enacted maps, on page 56?

A. Where are you referring to on 56?

Q. The last paragraph.

A. Right. Just with the same caveat that I was just operationalizing those terms cracking and packing in the way we discussed at length earlier today.

Q. I'm just trying to figure out -- we can go through the appendix. As I understand it, you looked at -- well, maybe it will be helpful to look to -- go to Appendix D5 and D3 on page 74 and 75, okay? Do have that in front of you?

A. Yes, sir.

Q. First one is titled Comparison of Each Enacted Plan District to the District that Geographically Overlaps Most with the

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Enacted District. And then D3 is a Comparison of the Enacted Plan District to Simulated District Containing at least 50 Percent of the Enacted District's Population.

I assume from your report that your judgement on the packing and cracking that we just talked about was based on the comparison with the 50 percent of the enacted district's population, not based on the one that geographically overlaps most, but tell me if I'm wrong.

A. That is my recollection of what I did, it was Appendix D3 is the one we're talking about here.

Q. Right.

A. That's my recollection. I think I spelled out somewhere in the report exactly what I was -- which figure we were looking at.

Q. Right. And I'm trying to save time, but stop me if you need to.

As I understood it what you did is you said it was a partisan outlier and packed and cracked, and was outside that middle 95 percent range that we talked about comprising the districts where you have a 50 percent overlap in population.

A. I think that's basically right. I was constructing the 95 percent interval.

Q. Yes.

A. And then asking whether or not the enacted district in each

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of these rows was inside or outside of that 95 percent interval.

Q. Okay. So let's look at D3 in your appendix, D3, okay. And you may have to go back, I apologize, to make sure I'm not misleading you. But you listed District 1 on page 56 as one of these partisan outliers. You can keep going back if you need to, it's page 56.

A. I gotcha.

Q. So I want to ask you some questions about CD-1.

The only thing I see on your graph there is a more Republican district, a somewhat safer Republican district. Why would that be a packed or cracked partisan outlier? Am I misunderstanding? The star is the enacted plan district, right?

A. Correct.

Q. And the thing to its right, meaning more Republican, is the 50 percent of the enacted plan -- the simulated plans that overlap by 50 percent.

So how could CD-1, if it's less Republican, be a pro-Republican district?

A. Okay. Well all I'm doing here as I said a moment ago is I am just looking at -- and this is a purely technical exercise.

Q. Okay.

A. I'm just looking at the middle 95 percent range. And I'm just asking is that red star representing the enacted

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Congressional District 1, each Congressional district here, is it inside or outside of that range. And if it's outside, I'm listing that in that paragraph.

Q. Okay.

A. And all I meant to say is I didn't -- I obviously didn't intend to, and I apologize if I accidentally misled you with that paragraph regarding the partisan direction of that. I simply said what's a 95 percent interval, and if it was outside of that, then it would be listed.

Q. All right. So I had a lot of those questions along those lines, but I'm again going to cut to the chase with you.

If I understand what you just said correctly, if the enacted plan is outside of the range represented by these, I don't know what else to call it, the concentrated circles, I don't want to call them blobs, but if they're outside of that, then that's the decision-making process that led you to include them among the districts that you categorized as partisan outliers; whereas if the star appears within those districts, within the blobs, then you don't characterize them that way?

A. That's basically right . Again, it is a purely statistical exercise here. And obviously you and I talked quite a bit at length earlier today about how I was attempting to just operationalize, even though I don't have a particular scientific understanding of the terms cracking and packing, I

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just took a very specific statistical identification here where I said, what's the 95 percent interval, that middle 95 percent range, and is the enacted district within or outside of it.

That's it. I just wanted to make sure that was clear.

Q. Okay. Well even in light of that, I thank you because that saved us a boat load of time.

I'm still a little confused.

If you could turn to Appendix D6 on page 78, right? And again, check me on page 56, but I think you list District 8 as one of these partisan outliers, that Senate District 8 if you want to check me on page 56?

A. On 56.

Q. I'm representing to you that you listed SD-8 as one of the partisan outliers. If you want to check my veracity you can look at page 56 and see if I got that right.

A. I gotcha.

Q. So now I have a question about SD-8 based on the thing on page 78.

I would have thought that that circle would have been between the two blobs, so it wouldn't have been a partisan outlier under the mechanistic view that you just described. So how did SD-8 wind up on this list?

A. Right. I think what you're saying is you're seeing two

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distinct blobs.

Q. Yes.

A. And you can't understand why 95 percent of them would be on one side rather than the other. And I get where you're coming from.

Q. Right.

A. The answer again is I actually did just construct a middle 95 percent interval. And I realize that it's difficult to concern how many circles are here, and obviously I don't have the data file in front of me here to be able to prove it to you or verify it right in front of us. But again what I did here --

Q. So your --

A. Let me just --

Q. Sure.

A. What this figure is doing is just stacking a bunch of gray circles on top of each other, and often it's in a very close cluster.

It is actually really to be able to look at one of these clusters and be able to discern and accurately estimate whether that's several hundred or just 50 or 20 or so circles. That's why it's probably -- it's not a safe bet to try to just look at the blobs and try to estimate out those numbers.

But again what I'm saying what I did was I actually

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did calculate the middle 95 percent range. And just because you see a blob there doesn't necessarily mean -- on the left, doesn't necessarily mean it's as big as the blob on the right.

Q. Right. I guess you're going to give me the same answer if you look at SD-27 real quickly?

The star is within the blob, but it's at the far end. So I take it the reason that's identified as an outlier is it's outside the 95 percent middle range?

A. Right. Same answer as before.

Q. Same answer?

A. Obviously I don't have the data here to verify it right here on the spot.

Q. Right.

A. But you see that blob and it's hard to precisely discern are there really a lot of gray circles at the very left hand, or just a small number. But my calculation was take that middle 95 percent range.

Q. Okay. And then if you could turn quickly to Appendix D1, please.

A. (Witness complied.)

Q. Okay.

A. Let me just get there. I gotcha.

Q. So in this one you -- and again I'm trying to cut to the chase here. You mentioned this in your report, you present

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this table. But I didn't see you attach any significance to ranking the Congressional plans or the other plans' districts alined from least to most Republican. Is that part of your cracking or packing analysis? Is this part of that?

A. It's a different sort of analysis just looking at outliers. And since you asked about packing and cracking obviously I'm giving the same caveat as before, I don't understand those terms in any sort of scientific, precise, objective way.

But this Appendix D1 figure is just generally part of my analysis of district-by-district outliers. And it's just configured in a slightly different way where I'm lining up the districts from least to most Republican within each plan. So that's a little bit different than the figures that you and I were just talking about a moment ago because now we're not looking at, say, the simulated districts that geographically overlap with an active Congressional district, but instead we're looking at the most Democratic district at the very bottom. Then we're looking at the second most Democrat district on the second row. In the third row, we're looking at the third most Democratic district, and so on.

So it's just a somewhat different basis of comparison for looking at partisan outliers in this form.

Q. All right. If you could turn to page four of your report, please.

MR. YEAGER: Page four?

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MR. CARVIN: Four.

BY MR. CARVIN:

Q. The only reason I'm directing you to this is the last paragraph where you say, the algorithm freezes the enacted plan's boundaries of House Districts 1 through 10. Do you see that in the fourth paragraph there?

A. Yes, I see that.

Q. And that's consistent with your recollection, you froze House Districts 1 through 10?

A. Yes, there was more than that. But House Districts 1 through 10 were certainly frozen.

Q. Okay. And then if you look at HD-2, okay, turn to page 80 I'll represent to you that all the other House -- we talked about Flint before, but the other ones, HD-1 through 10 you just see one star and one blob around it, and I assume that's the consequence of the freeze?

A. Yes.

Q. But if you go to HD-2, you see the star at the far end of a big blob, which suggests to me that there was alternative versions of HD-2. But please explain.

A. No, that's not correct. You were correct all the way up until the end, so I'll clarify where the misunderstanding I think on your part came from.

Q. Okay.

A. So we're on Appendix D8, right? I just want to make sure.

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Q. Right.
A. So HD-2, the row for HD-2 is the 17th row from the bottom, you see that, right?
Q. Yes.
A. So what that means is HD-2 in the enacted plan is the 17th most Democratic district ranked by Republican -- by partisan vote share. And that is how I ordered the enacted districts along the vertical axis of this figure.
Now I rank ordered the districts in the simulated plans, the one thousand simulated plans, using exactly that same measure ranked from --
Q. Please finish.
A. I'm happy to interrupt my explanation there.
Q. Because I'm just going to confirm if I do have it. If you look at appendix D-4 on page 76?
A. Okay. Let me get to where you are.
Q. Do you have that?
A. Yes, sir.
Q. Okay. I'm going to ask you to trust me that you said you froze SD-6 and SD-7, and you had the same kind of configuration that I just identified for the House district.
I take it your explanation for SD-6 and SD-7 is essentially the same you just gave me for the House district, why there is blobs and all that because this is a rank ordering exercise?

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A. Right. Same thing again. So there SD-6, you see that's the tenth row from the bottom, that means SD-6 is listed there along with those gray circles as the tenth most Democratic district in each enacted and simulated plan.
So all those gray blobs, all the gray circles that you see on that tenth row, those are not referring to simulated districts in the same geographic area as SD-6, instead they're referring to the tenth most Democratic district.
Q. Whatever -- and it's undoubtedly not the same number, it's a different number. Whatever it is, it just happens to be the tenth most in your example?
A. Right. So SD-6, even though it's frozen in every plan, is not necessarily the tenth most Democratic district in each plan.
Q. I'll try it one last time to make sure I got it straight. You're not comparing SD-6 in the enacted plan to the simulated plans, you're comparing SD-6 in the enacted plan to whatever district corresponds with it in the rank ordering of Democratic and Congressional districts?
A. Exactly.
Q. Right.
A. That district may well be in a completely different part of the state.
Q. Okay.

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MR. CARVIN: Can you give me one second?
(At 5:50 p.m. went off the record.)
(At 5:50 p.m. went on the record.)
MR. CARVIN: For your sake as well as my own, I want to end this pleasant exercise. We have no further questions.
THE WITNESS: Thank you, sir.
(Deposition concluded at 5:51 p.m.)

CERTIFICATION OF COURT REPORTER AND NOTARY PUBLIC

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STATE OF MICHIGAN)
) SS
COUNTY OF MUSKEGON)

I certify that this transcript, consisting of 281 pages, is a complete, true and correct record of the testimony of JOWIE CHEN held in this case on September 7, 2018.

I also certify that prior to taking this deposition JOWIE CHEN was duly sworn to tell the truth.

DATE: September 9, 2018

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